Tetra Tech EM Inc.

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September 10, 2001

Ms. Amy Williams
Remedial Project Manager
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street, SW 11th Floor
Atlanta, Georgia 30303

Subject: **Final Expanded Site Inspection Report**
Jordan Sign Company
EPA Contract No. 68-W-00-120
EPA ID No. GAD003293057
Technical Direction Document No. 4T-01-10-A-007

Dear Ms. Williams:

The Tetra Tech EM Inc. Superfund Technical Assessment and Response Team (START) is submitting one copy of the final expanded site inspection (ESI) report for the Jordan Sign Company in Savannah, Chatham County, Georgia. Per our conversation today, EPA Region 4 has reviewed the draft ESI report dated September 4, 2001, and has no comments on the draft ESI report. Due to your acceptance of the draft ESI report, Tetra Tech EM Inc., is submitting only the cover page for the final report.

If you have any questions or comments regarding this submittal, please contact me at (678) 775-3081.

Sincerely,

David L. Brown
START Project Manager

Enclosure

cc: Matthew Monsees, EPA Project Officer (w/o enclosures)
Cindy Gurley, EPA Process Owner (w/o enclosures)
Steve Pierce, START Leader (w/o enclosures)
Paul Moisan, START Site Assessment Coordinator (w/o enclosures)
START File

FINAL EXPANDED SITE INSPECTION REPORT

JORDAN SIGN COMPANY
SAVANNAH, CHATHAM COUNTY, GEORGIA

US EPA ID NO. GAD003293057

Revision 1

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Region 4
Atlanta, Georgia 30303

Contract No.	:	68-W-00-120
TDD No.	:	4T-01-10-A-007
Date Prepared	:	September 10, 2001
EPA Task Monitor	:	Amy Williams
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Prepared by	Reviewed by	Approved by
David L. Brown	Sandra J. Harrigan	for R. Steve Pierce
START Project Manager	START Technical Reviewer	START Leader

FINAL EXPANDED SITE INSPECTION REPORT

JORDAN SIGN COMPANY
SAVANNAH, CHATHAM COUNTY, GEORGIA

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Revision 1

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) directed the Tetra Tech EM Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) to conduct an expanded site inspection (ESI) at the Jordan Sign Company, EPA ID No. GAD003293057, under Contract No. 68-W-0021, Technical Direction Document No. 04-9902-0005. The ESI was completed under Contract No. 68-W-00-120, TDD No. 4T-01-10-A-007.

The primary objective of an ESI is to determine whether a facility has the potential to be placed on the National Priorities List (NPL). The NPL identifies facilities at which a release, or threatened release, of hazardous substances poses a risk to public health or the environment sufficient to warrant further investigation and possible remediation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act of 1986.

Information gathered during the ESI is used to generate a preliminary Hazard Ranking System (HRS) score. The HRS score is the primary criterion EPA uses to determine whether a facility should be placed on the NPL. ESIs are generally conducted at facilities where additional environmental sampling or monitoring well installation is necessary to fulfill HRS documentation requirements. ESIs are also conducted to address issues not adequately resolved through previous investigations.

Specifically, the objectives of the ESI are as follows:

- Obtain and review relevant file material
- Collect samples to determine whether hazardous substances are attributable to facility operations
- Collect samples to establish representative background levels
- Evaluate target populations for the groundwater migration, surface water migration, soil exposure, and air migration pathways
- Collect any other data necessary to derive an HRS score
- Document current facility conditions
- Develop a facility layout map

This report documents the results of the ESI conducted at the facility during the week of March 26, 2001. Information reviewed for the ESI was gathered from EPA Region 4 CERCLA files.

2.0 SITE BACKGROUND

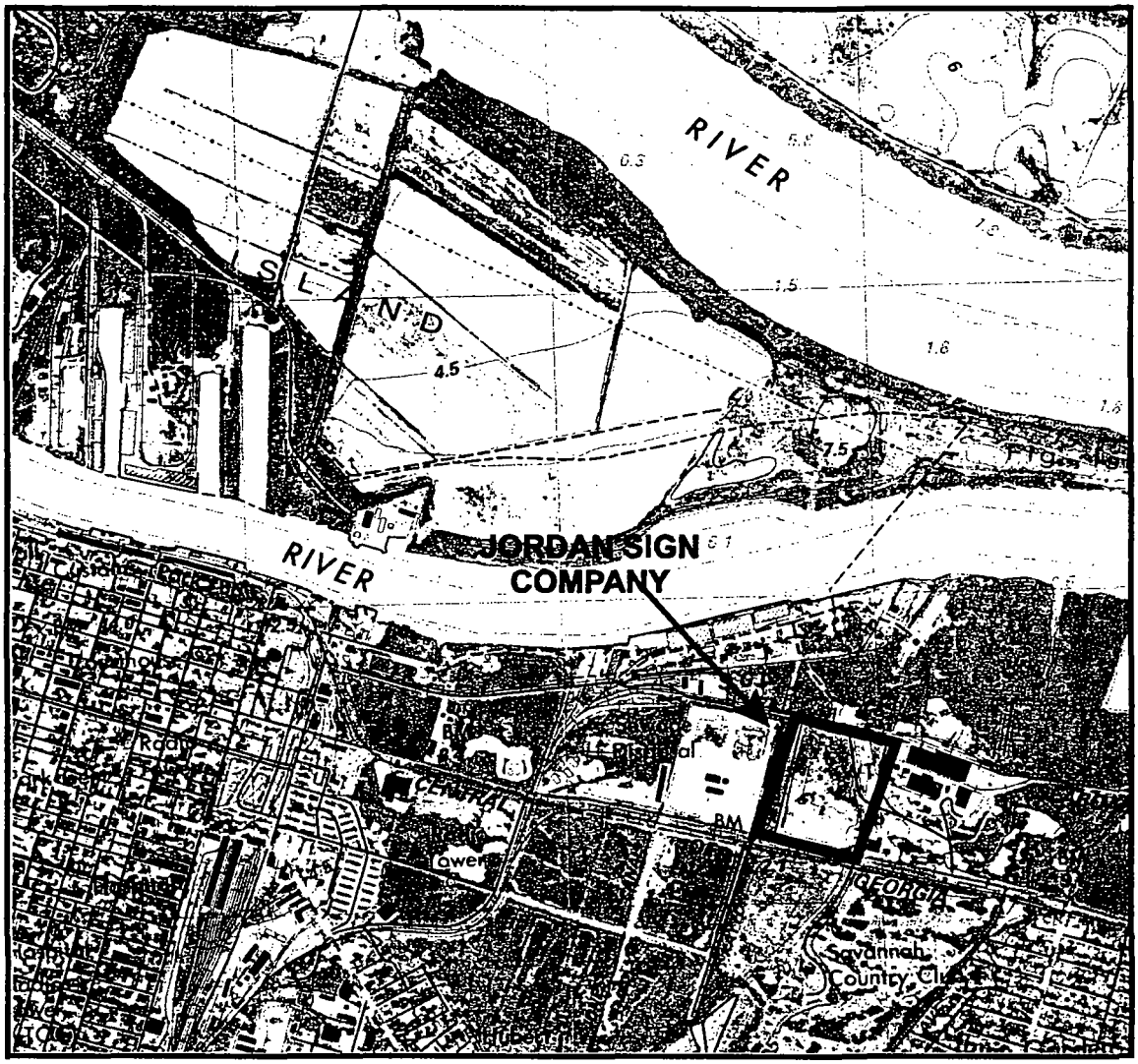
This section describes the facility, its present and past operations (including waste disposal practices and regulatory history), previous investigations, and potential source areas located at the facility.

2.1 SITE DESCRIPTION AND ENVIRONMENTAL SETTING

The Jordan Sign Company property is an inactive landfill located on the East President Street Extension in Savannah, Chatham County, Georgia. The geographical coordinates are latitude 32° 31' 28.0" N and longitude 89° 41' 23.0" W (see Figure 1) (Refs. 1; 2, pp. 1, 3; 3; 4; 5; 6, p. 23). The property is currently owned by Southern States Phosphate and Fertilizer Company (Refs. 7; 8; 9; 10). The landfill which is located on 24.38 acres of land, was used for the disposal of construction debris and dredge spoils sometime after the early 1960s until sometime prior to 1977. In 1979, it was reported that Hercules, Inc., had disposed of resin waste at the landfill. No further information is available in the site files concerning the types and quantities of waste deposited at the landfill (Refs. 2; 4; 5; 7; 8; 9; 10).

The land use of area surrounding the landfill is commercial and industrial. An apiary is currently located on the central portion of the landfill property, and a spoil disposal area is located on the southern portion of the property. The Southern States Phosphate and Fertilizer facility is located adjacent to the east-northeast portion of the landfill. Ind Chem, Inc., is located adjacent to the southeast corner of the landfill. The Savannah Country Club and golf course is located immediately southeast of the landfill across the East President Street Extension. Dulany Road borders the landfill property on both the west and north boundary. Located west of Dulany Road is a wooded area situated on the east bank of the Kayton Canal. The City of Savannah President Street Wastewater Treatment facility is located adjacent to the west bank of the Kayton Canal. The area directly south of the landfill property is a low lying swampy area that also borders the Kayton Canal (see Figure 2) (Refs. 1; 5; 6, p. 10; 7; 8; 9; 10). The Savannah River is located approximately 1,500 feet north of the landfill (Ref. 1). The landfill is located within the 100 year flood plain for the Kayton Canal and Savannah River (Ref. 11).

The climate of Chatham County is classified as warm, humid, and subtropical (Ref. 12, pp. 64, 67). The mean annual precipitation for the area is 48 inches, and the mean annual lake evaporation is 44 inches, yielding a net annual precipitation of 4 inches (Ref. 13). The 2-year 24-hour rainfall for the area is 5 inches (Ref. 14).



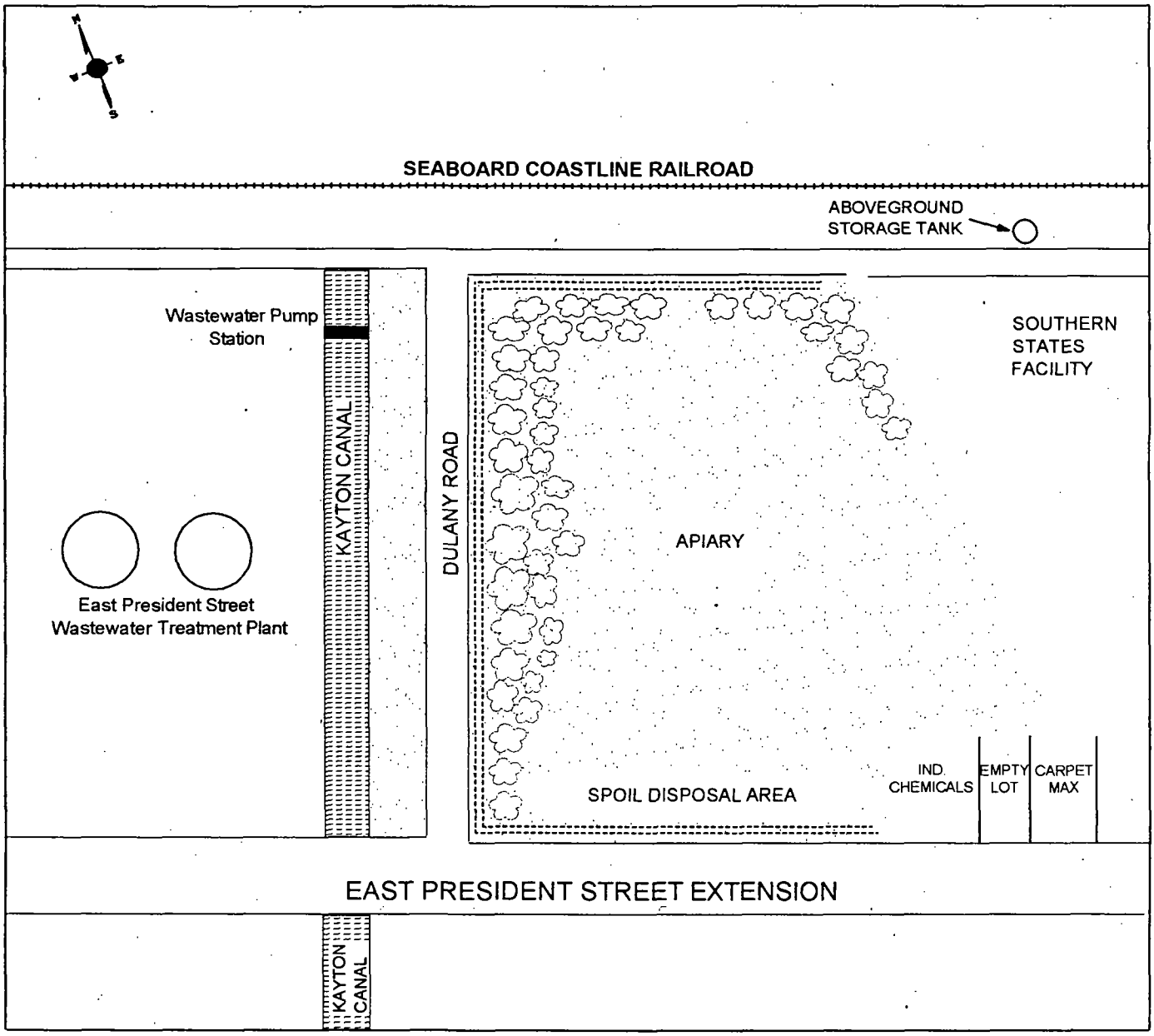
SCALE
1 = 24,000

MODIFIED FROM USGS 7.5 MINUTE QUADRANGLE: SAVANNAH QUADRANGLE GEORGIA 1978

JORDAN SIGN COMPANY
SAVANNAH, CHATHAM COUNTY, GEORGIA
TDD No. 4T-01-10-A-007
EPA ID No. GAD003293057

FIGURE 1 - GENERAL SITE MAP

Tetra Tech EM Inc. START



LEGEND

- JORDAN SIGN COMPANY PROPERTY
- WATER
- TREES
- DRAINAGE DITCH

NOT TO SCALE

JORDAN SIGN COMPANY
SAVANNAH, CHATHAM COUNTY, GEORGIA
EPA ID No. GAD003293057
TDD NO. 4T-01-10-A-007

FIGURE 2 - SITE LAYOUT MAP

TETRA TECH EM INC. START

2.2 SITE OPERATIONS AND REGULATORY HISTORY

The landfill, which is located on a 24.38-acre tract of land, was used for the disposal of construction debris and dredge spoils after the early 1960s until sometime prior to 1977. Hercules, Inc., reportedly had disposed of resin waste at the landfill at an unknown time. No other information is available concerning the types and quantities of waste deposited at the landfill (Refs. 2; 4; 5; 7; 8; 9; 10). The facility property is currently regulated under CERCLA (Refs. 15; 16).

2.3 PREVIOUS RELEASES AND INVESTIGATIONS

Several environmental investigations have been performed at the landfill. In May 1988, the EPA Field Investigation Team conducted a preliminary reassessment (PR) for the landfill (Ref. 4). General information regarding the landfill was collected during the investigation; however, no environmental samples were collected. The PR recommended a medium-priority screening site inspection (Ref. 4). On August 25, 1988, the Georgia Department of Natural Resources, Environmental Protection Division (EPD) conducted a field sampling investigation. The remains of deteriorated drums were visible in the northern section of the landfill property (Ref. 9, p. 2). The EPD collected two groundwater samples during the 1988 sampling investigation at the landfill. The groundwater samples were analyzed for selected inorganic constituents and volatile organic compounds (VOC) (Ref. 10, pp. 11, 12). No inorganic constituents or VOCs were detected in a background groundwater sample collected from a 360-foot-deep well located at the Savannah Country Club, less than 0.25 mile south of the landfill property. An on-site groundwater sample was collected from a shallow boring on the northern portion of the landfill property, where several inorganics were detected at elevated concentrations (Ref. 10, p. 11). In June 1996, Black & Veatch Special Projects Corp. (B & V) conducted a site inspection prioritization (SIP) for the landfill. Due to the limited information available concerning waste types and quantities, as well as the limited sampling information, B & V recommended that additional sampling be conducted at the landfill (Ref. 5).

The landfill property is currently being proposed for commercial use by Competitive Power Ventures (CPV) of Newburyport, Massachusetts. In February and March 2001, Hussey, Gay, Bell and DeYoung Environmental, Inc. (HGBD), in conjunction with TRC Environmental Corporation, performed a limited Phase II environmental field investigation for the proposed CPV Terrapin Power Project site on the landfill property (Ref. 17, p. 1). Six soil borings were advanced and soil samples were collected to ascertain subsurface soil conditions. In addition, six surface soil and six sediment samples were collected from ditches along the northern and southern property boundaries and from areas of apparent fill, spoil piles, and solid waste disposal areas. A rotary drill rig with hollow-stemmed augers was used to advance the boreholes at the six soil sampling locations. Two soil samples were collected from each soil boring using split-spoon techniques. Soil samples were collected from the ground surface, and the

subsurface soil sample was collected from the soil-groundwater interface. Permanent monitoring wells were also installed in the surficial aquifer at each of the soil boring locations, and groundwater samples were collected (Ref. 17, pp. 5 - 8, Appendix II). All soil samples collected from the soil borings were analyzed for total priority pollutant metals, semivolatile organic compounds (SVOC), pesticides, ammonia, fluoride, and soil pH. Sediment samples collected from the ditch located along the northern property line were analyzed for the same parameters as the soil boring samples. Only a select number of the soil samples were analyzed for VOCs and for toxicity characteristic leaching procedure (TCLP) lead (Ref. 17, pp. 4, 5). Laboratory analytical results indicated the presence of arsenic at concentrations above the Georgia Hazardous Site Response Act (HSRA) Notification Concentration (NC) standard in three samples collected from the soil borings. Several other heavy metals were also detected in surface and subsurface soil samples but at concentrations below the HSRA NC standards. TCLP analysis of a soil sample collected from soil boring B-6 indicated a lead concentration of 9.6 milligrams per liter (mg/l). A TCLP lead concentration of 5 mg/L or more is characteristic of a hazardous waste under provisions of the Resource Conservation and Recovery Act (RCRA; 40 CFR, 261.24). (Ref. 17, p. 3; 18). After soil sampling, soil borings B-1 through B-4 were completed as permanent groundwater monitoring wells
MW-1 through MW-4, respectively. In addition, one existing on-site groundwater monitoring well (MW-5) was sampled. The available file material does not indicate when this well was installed or by whom (Ref. 17, p. 8). Analytical results from the initial groundwater sampling by HGBD personnel indicated the presence of arsenic, thallium, and antimony at concentrations above both federal and state drinking water maximum contaminant levels (MCL) (Ref. 17, p. 9).

2.4 POTENTIAL SOURCE AREAS

The 24.38-acre landfill is the only source evaluated.

3.0 ESI ACTIVITIES

This section outlines field observations made and sampling procedures followed at the site during the ESI. Individual subsections address the sampling investigation and rationales for specific ESI activities. The ESI was conducted in accordance with the EPA-approved site-specific sampling plan (SSSP) dated September 6, 2000.

3.1 SAMPLE COLLECTION METHODOLOGY AND PROCEDURES

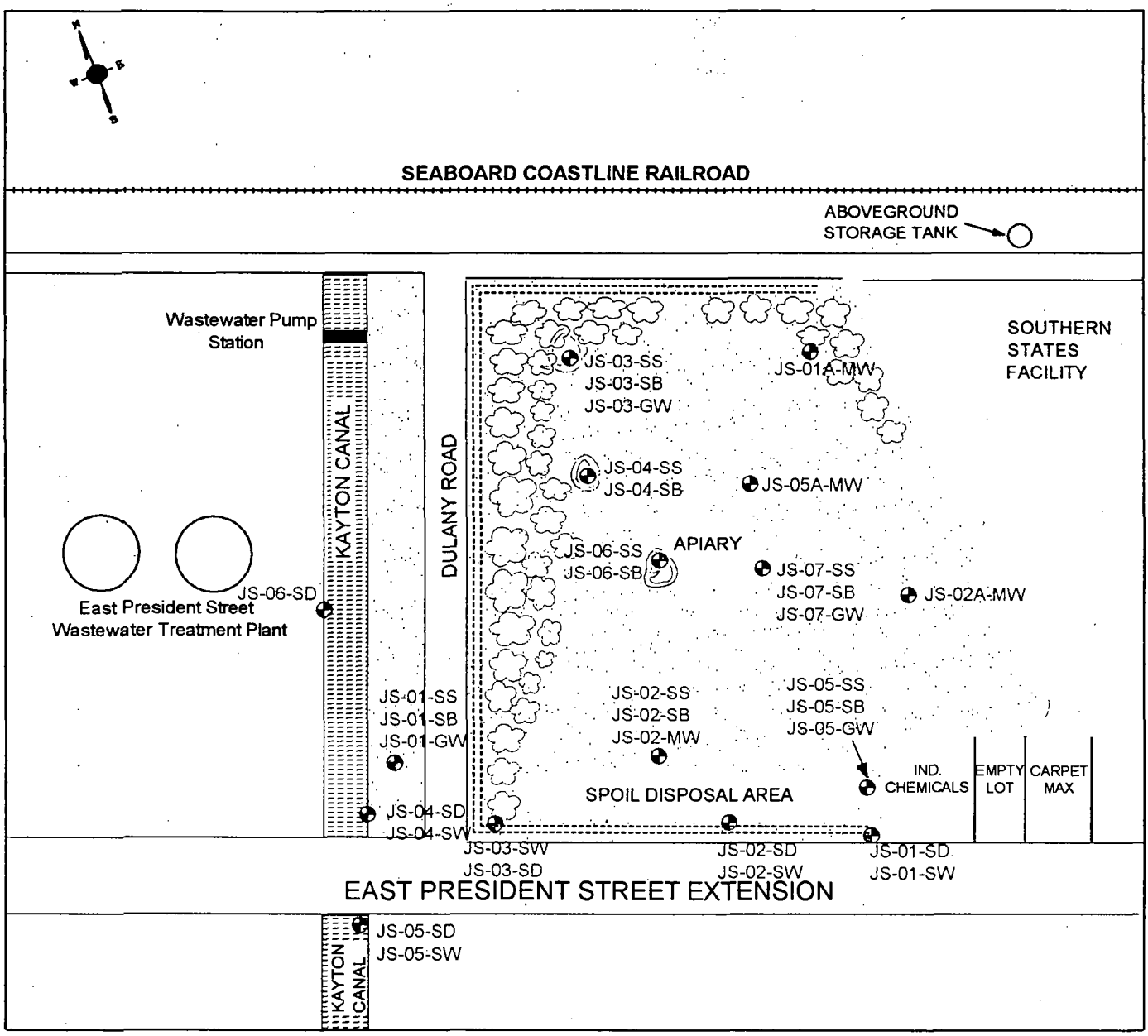
Tetra Tech personnel collected 7 surface soil, 7 subsurface soil, 11 groundwater, 6 surface water, and 6 sediment samples during the week of March 26, 2001. ESI sampling locations are shown on Figure 3 and summarized in Tables 1 through 5. Tetra Tech personnel collected the surface soil samples from 0 to 6 inches below land surface (bls). Subsurface soil samples were collected from greater than 2 feet bls. In addition, surface water samples were collected from the water surface, and sediment samples were collected from the sediment-surface water interface along the on-site stormwater drainage ditch and from the Kayton Canal. Tetra Tech personnel followed sample collection procedures outlined in the SSSP developed in accordance with the EPA Science and Ecosystem Support Division (SESD) Region 4 "Environmental Investigations Standard Operating Procedures and Quality Assurance Manual" (EISOPQAM, May 1996).

3.2 ANALYTICAL SUPPORT AND METHODOLOGY

All samples collected during the ESI were analyzed through the EPA Contract Laboratory Program (CLP). The laboratories analyzed for EPA target compound list (TCL) , VOCs, SVOCs, pesticides, and polychlorinated biphenyls (PCB). The samples were also analyzed for target analyte list inorganic substances (total metals and cyanide). EPA Region 4 SESD reviewed all data for compliance with the terms of the CLP. The complete set of analytical data sheets is presented in Appendix A.

3.3 ANALYTICAL DATA QUALITY AND DATA QUALIFIERS

All analytical data were subject to a quality assurance review as described in the EPA SESD laboratory data evaluation guidelines. In the text and analytical data tables presented in this report, some concentrations of the organic and inorganic parameters have been qualified with a "J," indicating that the qualitative analysis was acceptable; however, the quantitative value has been estimated. Other compounds may have been qualified with an "N," indicating that they were detected based on the presumptive evidence of their presence. This means that the compound was only tentatively identified, and its detection cannot be considered a positive indication of its presence. Results for some samples are reported with a "U" qualifier, meaning that an analysis was done; however, the constituent was not detected. Instead the reported number is the laboratory-derived sample quantitation limit (SQL) for the constituent in that sample. Sample results reported with an "R" qualifier indicate that the data are unusable. At times, miscellaneous organic compounds that do not appear on the TCL are reported with the data set. These constituents are qualified as "JN," indicating that they are tentatively identified at estimated quantities. An analysis for these constituents is not routinely conducted or reported, so



LEGEND

- JORDAN SIGN COMPANY PROPERTY
- WATER
- TREES
- DRAINAGE DITCH
- SAMPLE LOCATION

JS JORDAN SIGN COMPANY
SS SURFACE SOIL SAMPLE
SB SUBSURFACE SOIL SAMPLE
SD SEDIMENT SAMPLE
SW SURFACE WATER SAMPLE
GW GROUNDWATER SAMPLE
MW PERMANENT MONITORING WELL GROUNDWATER SAMPLE

NOT TO SCALE

JORDAN SIGN COMPANY
SAVANNAH, CHATHAM COUNTY, GEORGIA
EPA ID No. GAD003293057
TDD NO. 4T-01-10-A-007

FIGURE 3 - SAMPLING LOCATION MAP

TETRA TECH EM INC. START

TABLE 1
SURFACE SOIL SAMPLING LOCATIONS AND RATIONALE

Sample Number	Location	Rationale
JS-01-SS	Approximately 100 feet north of the East President Street Extension, and 75 feet west of Dulany Road in a grassy area Coordinates: 32° 04' 20.1" N, 81° 04' 02.5" W	Background surface soil sample for comparison to on-site sample results
JS-02-SS	Approximately 15 feet from permanent monitoring well MW-3. Coordinates: 32° 04' 19.8" N, 81° 03' 58.7" W	Determine presence or absence of hazardous substances
JS-03-SS	Extreme northwest corner of landfill Coordinates: None recorded	Determine presence or absence of hazardous substances
JS-04-SS	Northwestern portion of landfill Coordinates: 32° 04' 29.8" N, 81° 03' 56.4" W	Determine presence or absence of hazardous substances
JS-05-SS	Eastern portion of spoil disposal area Coordinates: 32° 04' 19.2" N, 81° 03' 57.7" W	Determine presence or absence of hazardous substances
JS-06-SS	Approximately 100 yards west of the on-site apiary Coordinates: 32° 04' 23.5" N, 81° 03' 58.6" W	Determine presence or absence of hazardous substances
JS-07-SS	Central portion of landfill Coordinates: 32° 04' 25.0" N, 81° 03' 54.7" W	Determine presence or absence of hazardous substances

Notes: JS - Jordan Sign Company
SS - Surface soil

TABLE 2
SUBSURFACE SOIL SAMPLING LOCATIONS AND RATIONALE

Sample Number	Location	Rationale
JS-01-SB	Approximately 100 feet north of the East President Street Extension, and 75 feet west of Dulany Road, in a grassy area Coordinates: 32° 04' 20.1" N, 81° 04' 02.5" W	Background subsurface soil sample for comparison to on-site sample results
JS-02-SB	Approximately 15 feet from permanent monitoring well MW-3 Coordinates: 32° 04' 19.8" N, 81° 03' 58.7" W	Determine presence or absence of hazardous substances
JS-03-SB	Extreme northwest corner of landfill Coordinates: None recorded	Determine presence or absence of hazardous substances
JS-04-SB	Northwest portion of landfill Coordinates: 32° 04' 29.8" N, 81° 03' 56.4" W	Determine presence or absence of hazardous substances
JS-05-SB	Eastern portion of spoil disposal area Coordinates: 32° 04' 19.2" N, 81° 03' 57.7" W	Determine presence or absence of hazardous substances
JS-06-SB	Approximately 100 yards west of the on-site apiary Coordinates: 32° 04' 23.5" N, 81° 03' 58.6" W	Determine presence or absence of hazardous substances
JS-07-SB	Central portion of landfill Coordinates: 32° 04' 25.0" N, 81° 03' 54.7" W	Determine presence or absence of hazardous substances

Notes: JS - Jordan Sign Company
SB - Subsurface soil

TABLE 3
GROUNDWATER SAMPLING LOCATIONS AND RATIONALE

Sample Number	Location	Rationale
JS-01-GW	Approximately 120 feet north of the East President Street Extension, and 75 feet west of Dulany Road in a wooded area Coordinates: 32° 04' 20.3" N, 81° 04' 2.2" W	Background groundwater sample for comparison to on-site sample results
JS-02-MW	On-site permanent monitoring well MW-3 Coordinates: 32° 04' 19.9" N, 81° 03' 58.7" W	Determine presence or absence of hazardous substances
JS-05A-MW	On-site permanent monitoring well MW-5 Coordinates: 32° 04' 25.5" N, 81° 03' 56.1" W	Determine presence or absence of hazardous substances
JS-02A-MW	On-site permanent monitoring well MW-2 Coordinates: 32° 04' 21.3" N, 81° 03' 53.4" W	Determine presence or absence of hazardous substances
JS-01A-MW	On-site permanent monitoring well MW-1 Coordinates: 32° 04' 27.1" N, 81° 03' 53.0" W	Determine presence or absence of hazardous substances
JS-03-GW	Extreme northwest corner of landfill Coordinates: 32° 04' 30.1"N, 81° 03' 57.6" W	Determine presence or absence or hazardous substances
JS-05-GW	Eastern portion of spoil disposal area Coordinates: 32°04'19.2N, 81°03'57.7"W	Determine presence or abasence of hazardous substances
JS-01-PW	Savannah Country Club private well	Background groundwater sample for comparison to downgradient sample results
JS-08-DW	Savannah Water & Sewer Bureau well No. 8 (Edgewood Rd & Pierpont Ave)	Determine presence or absence of hazardous substances
JS-11-DW	Savannah Water & Sewer Bureau Well No. 11 (Pennsylvania Ave & Harrison St)	Determine presence or absence of hazardous substances

TABLE 3 (Continued)

GROUNDWATER SAMPLING LOCATIONS AND RATIONALE

Sample Number	Location	Rationale
JS-16-DW	Eastern portion of spoil disposal area	Determine presence or absence of hazardous substances

Notes:

JS - Jordan Sign Company

DW - Savannah Water & Sewer Bureau Municipal Well

GW - Temporary monitoring well

MW - Permanent monitoring well

PW - Private well

TABLE 4
SURFACE WATER SAMPLING LOCATIONS AND RATIONALE

Sample Number	Location	Rationale
JS-01-SW	Storm water ditch, upgradient of the landfill Coordinates: 32° 04' 17.7" N, 81° 03' 56.3" W	Background sample for comparison to on-site results
JS-02-SW	Storm water ditch, midway between Dulany Road and the background surface water sampling location Coordinates: 32° 04' 18.4" N, 81° 03' 58.7" W	Determine presence or absence of hazardous substances
JS-03-SW	Storm water ditch, near intersection of Dulany Road and East President Street Extension Coordinates: 32° 04' 19.1" N, 81° 04' 01.2" W	Determine presence or absence of hazardous substances
JS-04-SW	Confluence of storm water ditch and Kayton Canal Coordinates: 32° 04' 19.8" N, 81° 04' 04.2" W	Determine presence or absence of hazardous substances
JS-05-SW	East bank of Kayton Canal, approximately 10 feet south of East President Street Extension bridge Coordinates: 32° 04' 18.8" N, 81° 04' 04.6" W	Determine presence or absence of hazardous substances
JS-06-SW	Kayton Canal, at former outfall for the East President Street Water Treatment Plant Coordinates: 32° 04' 23.1" N, 81° 04' 03.5" W	Control surface water sample for comparison to surface water samples from Kayton Canal

Notes: JS - Jordan Sign Company
SW - Surface water

TABLE 5
SEDIMENT SAMPLING LOCATIONS AND RATIONALE

Sample Number	Location	Rationale
JS-01-SD	Storm water ditch, upgradient of the landfill **	Background sediment sample for comparison to on-site results
JS-02-SD	Storm water ditch, midway between Dulany Road and the background surface water sampling location **	Determine presence or absence of hazardous substances
JS-03-SD	Storm water ditch, near intersection of Dulany Road and East President Street **	Determine presence or absence of hazardous substances
JS-04-SD	Confluence of storm water ditch and Kayton Canal **	Determine presence or absence of hazardous substances
JS-05-SD	East bank of Kayton Canal, approximately 10 feet south of East President Street bridge **	Determine presence or absence of hazardous substances
JS-06-SD	Kayton Canal, at former outfall for the East President Street Water Treatment Plant **	Control surface water sample for comparison to surface water samples from Kayton Canal

Notes: JS - Jordan Sign Company
SD - Sediment
** - Sediment sample coordinates are the same as the surface water sampling locations

background levels or SQLs are not generally available for comparison. The complete set of analytical data sheets is presented in Appendix A.

4.0 SOURCE SAMPLING

This section discusses the source areas evaluated at the facility and the sampling locations and analytical results of samples collected from the source areas. Source areas evaluated during this ESI include the entire landfill property.

ESI surface and subsurface soil sampling locations are shown on Figure 3 and described in Tables 1 and 2. ESI surface soil inorganic and organic analytical results are summarized in Tables 6 and 7, respectively. ESI subsurface soil inorganic and organic analytical sampling results are summarized in Tables 8 and 9, respectively. Tables 1 and 2 are presented following Section 3.1; Tables 6 through 9 are presented following Section 4.2. Elevated concentrations of constituents are shaded in the tables. The concentration of a constituent is considered to be elevated if it is greater than or equal to three times the concentration detected in the background or control sample. In cases where a constituent was not detected in the background or control sample, any concentration equal to or greater than the SQL is considered to be elevated. The complete set of analytical data sheets is presented in Appendix A.

The following discussion of hazardous constituents detected at elevated levels in soil samples collected at the landfill includes those hazardous constituents that may pose a threat to human health or the environment.

4.1 SOURCE SAMPLING LOCATIONS AND ANALYTICAL RESULTS

Tetra Tech personnel collected six surface soil samples and six subsurface soil samples from various locations on the landfill property during the ESI. In addition, one background surface soil sample (JS-01-SS) and one background subsurface soil sample (JS-01-SB) were collected in a grassy area approximately 100 feet north of the East President Street Extension and 75 feet west of Dulany Road (Ref. 6, p. 21). The ESI on-site surface and suburface soil sampling locations are described in Tables 1 and 2 following Section 3.3.

Analytical results for surface soil samples collected at the landfill indicated elevated concentrations of several inorganic constituents of concern including aluminum, arsenic, barium, cadmium, cobalt, chromium, copper, lead, manganese, total mercury, nickel, silver, vanadium, and zinc (see Table 6). Aluminum was detected in three surface soil samples at elevated concentrations ranging from 7,600J milligrams per kilogram (mg/kg) in sample JS-04-SS to 14,000J mg/kg in sample JS-06-SS. Arsenic was detected at an elevated concentration of 51 mg/kg in surface soil sample JS-03-SS. Barium was detected

in two surface soil samples at elevated concentrations of 160 mg/kg in sample JS-04-SS and 240 mg/kg in sample

JS-03-SS. Cadmium was detected at an elevated concentration of 2.5 mg/kg in sample JS-04-SS. Chromium was detected in three surface soil samples at elevated concentrations ranging from 29 mg/kg in sample JS-06-SS to 320 mg/kg in sample JS-03-SS. Cobalt was detected at an elevated concentration of 23 mg/kg in sample JS-03-SS. Copper was detected in two surface soil samples at elevated concentrations of 160 mg/kg in sample JS-04-SS and 180 mg/kg in sample JS-03-SS. Lead was detected in two surface soil samples at elevated concentrations of 520 mg/kg in sample JS-04-SS and 2,500 mg/kg in sample JS-03-SS. Manganese was detected in three surface soil samples at elevated concentrations ranging from 360 mg/kg in sample JS-04-SS, to 1,300 mg/kg in sample JS-03-SS. Total mercury was detected in two surface soil samples at elevated concentrations of 0.81 mg/kg in sample JS-03-SS and 1.7 mg/kg in sample JS-04-SS. Nickel was detected in two surface soil samples at elevated concentrations of 58 mg/kg in sample JS-03-SS and 72 mg/kg in sample JS-04-SS. Silver was detected in two surface soil samples at elevated concentrations of 4.8J mg/kg in sample JS-04-SS and 7.0J mg/kg in sample JS-03-SS. Vanadium was detected in three surface soil samples at elevated concentrations ranging from 29 mg/kg in sample JS-04-SS to 46 mg/kg in sample JS-06-SS. Zinc was detected in two surface soil samples at elevated concentrations of 2,100 mg/kg in sample JS-04-SS and 2,400 mg/kg in sample JS-03-SS (see Appendix A).

Organic compounds detected at elevated concentrations in on-site surface soil samples were acetone, dieldrin, hepatchlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, gamma chlordane/2, PCB-1254, and PCB-1260 (see Table 7). Acetone was detected at an elevated concentration of 11,000 micrograms per kilogram (µg/kg) in surface soil sample JS-02-SS. Dieldrin was detected at elevated concentration of 30 µg/kg in sample JS-03-SS. Hepatchlor epoxide was detected at an elevated concentration of 17 µg/kg in surface soil sample JS-04-SS. 4,4'DDE was detected at an elevated concentration of 83 µg/kg in surface soil sample JS-04-SS. 4,4'-DDD was detected at elevated concentration of 49 µg/kg in surface soil sample JS-04-SS. 4,4'-DDT was detected at an elevated concentration of 280 µg/kg in surface soil sample JS-04-SS. Gamma chlordane/2 was detected at an elevated concentration of 85 µg/kg in sample JS-04-SS. PCB-1254 was detected at an elevated concentration of 880 µg/kg in sample JS-03-SS, and PCB-1260 was detected at elevated concentration of 310 µg/kg in surface soil sample JS-03-SS. Additionally, numerous miscellaneous organic compounds were detected in the surface soil samples (see Appendix A).

Analytical results for subsurface soil samples collected at the landfill indicated elevated concentrations of several inorganic constituents of concern, including aluminum, arsenic, barium, chromium, copper, lead, manganese, vanadium, and zinc (see Table 8). Aluminum was detected inf four subsurface soil samples at elevated concentrations ranging from 2,900J mg/kg in sample JS-07-SB to 15,000J mg/kg in sample

JS-03-SB. Arsenic was detected at an elevated concentration of 53 mg/kg in sample JS-04-SB. Barium was detected in four subsurface soil samples at elevated concentrations, ranging from 14 mg/kg in sample JS-07-SB to 57 mg/kg in sample JS-03-SB. Chromium was detected in four subsurface soil samples at elevated concentrations ranging from 3.1 mg/kg in sample JS-07-SB to 36 mg/kg in subsurface soil sample JS-03-SB. Copper was detected in four subsurface soil samples at elevated concentrations ranging from 5.6 mg/kg in sample JS-02-SB to 130 mg/kg in sample JS-04-SB. Lead was detected in three subsurface soil samples at elevated concentrations ranging from 21 mg/kg in sample JS-06-SB to 100 mg/kg in sample JS-04-SB. Manganese was detected in three subsurface soil samples at elevated concentrations ranging from 38 mg/kg in sample JS-06-SB to 70 mg/kg in sample JS-04-SB. Vanadium was detected at in three subsurface soil samples at elevated concentrations ranging from 19 mg/kg in sample JS-06-SB to 51 mg/kg in sample JS-03-SB. Zinc was detected in five subsurface soil samples at elevated concentrations ranging from 5.2 mg/kg in sample JS-02-SB to 470 mg/kg in sample JS-03-SB.

Organic compounds detected at elevated concentrations in on-site subsurface soil samples were acetone, benzo-a-pyrene, benzo(ghi)perylene, dieldrin, heptachlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, and gamma-chlordane/2 (see Table 9). Acetone was detected in two subsurface soil samples at elevated concentrations of 60J µg/kg in sample JS-02-SB and 77 µg/kg in sample JS-04-SB. Benzo(a)pyrene was detected in two subsurface soil samples at elevated concentrations of 530 µg/kg in sample JS-04-SB and 560 µg/kg in subsurface soil sample JS-07-SB. Benzo(ghi)perylene was detected in two subsurface soil samples at elevated concentrations of 860 µg/kg in sample JS-04-SB and 1,500 µg/kg in sample JS-07-SB. Dieldrin (40 µg/kg), heptachlor epoxide (2.7J µg/kg), 4,4'-DDE (7.3 µg/kg), 4,4'-DDD (4.9J µg/kg),
4,4'-DDT (20 µg/kg), gamma-chlordane/2 (10 µg/kg) were all detected at elevated concentrations in subsurface soil sample JS-04-SB. In addition, numerous miscellaneous organic compounds were detected at elevated concentrations in the subsurface soil samples (see Appendix A).

4.2 SOURCE CONCLUSIONS

The analytical results for on-site surface and subsurface soil samples indicate the presence of surficial and subsurface contamination at various locations throughout the landfill. Several inorganic constituents, including aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, silver, vanadium, and zinc, were detected at elevated concentrations in on-site surface soil samples. Inorganic constituents detected at elevated concentrations in on-site subsurface soil samples include aluminum, arsenic, barium, chromium, copper, lead, manganese, vanadium, and zinc. Organic compounds detected at elevated levels in on-site surface soil samples were acetone, dieldrin, heptachlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, gamma-chlordane/2, PCB-1254, and PCB-1260. Organic compounds detected at elevated concentrations in on-site subsurface soil samples were acetone, benzo(a)pyrene, benzo(ghi)perylene, dieldrin, heptachlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT,

TABLE 6

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES

SAMPLE NUMBER							
	Background	On Site					
ANALYTE (mg/kg)	JS-01-SS	JS-02-SS	JS-03-SS	JS-04-SS	JS-05-SS	JS-06-SS	JS-07-SS
Aluminum	1,800J	730J	9,500J	7,600J	430J	14,000J	3,000J
Arsenic	2.8U	--	51	--	--	--	--
Barium	18	6.7	240	160	4.2	34	12
Cadmium	0.09U	--	--	2.5	--	--	--
Calcium	1,000	880	21,000	26,000	550	1,600	2,500
Chromium	6.4	2.4	320	41	--	29	3.2
Cobalt	0.35U	--	23	--	--	--	--
Copper	9.1	5.6	180	160	--	24	8.6
Iron	3,100	1,700	200,000	46,000	1,200	22,000	820
Lead	50	8.6	2,500	520	1.9	26	9.0
Magnesium	250	190	860	1,300	84	1,500	160
Manganese	47	40	1,300	360	26	400	24
Mercury (Total)	0.06U	--	0.81	1.7	--	--	--
Nickel	2.0U	--	58	72	--	--	--
Potassium	120J	70J	660J	720J	50J	1,100J	110J
Silver	0.51U	--	7.0J	4.8J	--	--	--
Sodium	100	100	340	490	100	310	140
Vanadium	6.7U	--	31	29	--	46	--
Zinc	36	25	2,400	2,100	12	75	83

Notes:

mg/kg	Milligrams per kilogram
JS	Jordan Sign Company
SS	Surface soil sample
U	Constituent analyzed for but not detected; value reported is the sample quantitation limit (SQL)
J	Estimated value
--	Constituent analyzed for but not detected

Shaded areas indicate elevated concentrations of constituents

TABLE 7

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES

COMPOUND (µg/kg)	SAMPLE NUMBER						
	Background	On Site					
	IS-01-SS	IS-02-SS	IS-03-SS	IS-04-SS	IS-05-SS	IS-06-SS	IS-07-SS
Volatiles							
Acetone	11U	11,000	--	--	--	--	--
Methyl Acetate	2J	--	3J	--	1J	--	3J
Extractables							
Benzaldehyde	380U	--	--	140J	--	--	--
Phenanthrene	39J	--	--	79J	--	--	--
Fluoranthene	160J	--	100J	170J	--	46J	--
Pyrene	110J	--	98J	190J	--	--	--
Benzo(a)anthracene	59J	--	56J	110J	--	--	--
Chrysene	96J	--	84J	170J	--	--	--
Benzo(b)fluoranthene	91J	--	60J	170J	--	--	--
Benzo(k)fluoranthene	71J	--	57J	110J	--	--	--
Benzo-a-pyrene	55J	--	--	120J	--	--	--
Indeno(1,2,3-cd)pyrene	64J	--	--	180J	--	--	--
Dibenzo(a,h)Anthracene	380UJ	--	--	79J	--	--	--
Benzo(ghi)perylene	380UJ	--	--	180J	--	--	--

TABLE 7 (CONTINUED)

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE SOIL SAMPLES

COMPOUND (µg/kg)	SAMPLE NUMBER						
	Background	On Site					
	JS-01-SS	JS-02-SS	JS-03-SS	JS-04-SS	JS-05-SS	JS-06-SS	JS-07-SS
Pesticides/PCBs							
Beta-BHC	1.9U	--	--	--	--	--	1.7 J
Heptachlor	1.9U	--	1.2J	2.8 JN	--	--	--
Dieldrin	3.8U	--	30	320N	--	--	--
Heptachlor Epoxide	1.9U	--	--	17	--	--	--
4,4'-DDE	3.8U	--	39 N	83	--	--	--
4,4'-DDD	3.7U	--	--	49	--	--	--
4,4'-DDT	3.8U	--	--	280	--	--	--
Gamma-chlordane/2	1.9U	--	--	85	--	--	--
Methoxychlor	19U	--	22J	--	--	--	--
Alpha-chlordane /2	1.9U	--	89N	110 N	--	--	--
PCB-1254	38U	--	880	--	--	--	--
PCB-1260	38U	--	310	--	--	--	--

Notes:

mg/kg	Milligrams per kilogram
JS	Jordan Sign Company
SS	Surface soil sample
U	Constituent analyzed for but not detected; value reported is the sample quantitation limi.
J	Estimated value
--	Constituent analyzed for but not detected
N	Presumptive evidence of presence of material

Shaded areas indicate elevated concentrations of constituents

TABLE 8

SUMMARY OF INORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES

ANALYTE (mg/kg)	SAMPLE NUMBER On Site						
	JS-01-SB	JS-02-SB	JS-03-SB	JS-04-SB	JS-05-SB	JS-06-SB	JS-07-SB
Aluminum	280J	240J	15,000J	12,000J	320J	12,000J	2,900J
Arsenic	1.6U	--	--	53	--	--	--
Barium	2.7	2.2	57	52	3.3	25	14
Calcium	520	580	9,800	5,500	820	1,600	510
Chromium	1.2U	--	36	26	--	14	3.1
Copper	3.7U	5.6	58	130	--	12	--
Iron	550	900	10,000	15,000	930	12,000	790
Lead	1.2	--	74	100	--	21	3.2
Magnesium	74	59	810	970	62	420	94
Manganese	6.8	18	48	70	18	38	5.9
Potassium	38UJ	--	720J	670J	--	320J	61J
Sodium	120	94	790	390	96	200	130
Vanadium	1.1U	--	51	39	--	19	--
Zinc	4.3U	5.2	470	230	--	30	6.2

Notes:

mg/kg	Milligrams per kilogram
JS	Jordan Sign Company
SS	Surface soil sample
U	Constituent analyzed for but not detected; value reported is the sample quantitation limit
J	Estimated value
--	Constituent analyzed for but not detected

Shaded areas indicate elevated concentrations of constituents

TABLE 9

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES

COMPOUND (µg/kg)	SAMPLE NUMBER						
	Background	On Site					
	IS-01-SB	IS-02-SB	IS-03-SB	IS-04-SB	IS-05-SB	IS-06-SB	IS-07-SB
Volatiles							
Acetone	11U	60 J	--	77	--	--	--
Methyl Acetate	11U	--	--	3J	--	--	--
Extractables							
Benzaldehyde	75J	--	120J	100J	--	--	--
Phenanthrene	350U	--	--	--	--	--	--
Fluoranthene	350U	--	--	--	--	--	--
Pyrene	350UJ	--	--	--	--	--	--
Benzo(a)anthracene	350U	--	--	--	--	--	--
Chrysene	350U	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	350U	--	--	680	--	--	--
benzo(b)fluoranthene	350U	--	--	--	--	--	--
benzo(k)fluoranthene	350U	--	--	--	--	--	--
benzo-a-pyrene	350U	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	350U	--	--	--	--	--	--
Dibenzo(a,h)Anthracene	350UJ	--	--	--	--	--	--
Benzo(ghi)perylene	350UJ	--	--	--	--	560J	--

TABLE 9 (CONTINUED)

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES

COMPOUND (µg/kg)	SAMPLE NUMBER						
	Background	On Site					
	JS-01-SB	JS-02-SB	JS-03-SB	JS-04-SB	JS-05-SB	JS-06-SB	JS-07-SB
Pesticides/PCBs							
Dieldrin	3.5U	--	--	40	--	--	--
Heptachlor Epoxide	1.8U	--	--	2.7J	--	--	--
4,4'-DDE	3.5U	--	--	7.3	--	1.5JN	--
4,4'-DDD	3.5U	--	--	4.9J	--	--	--
4,4'-DDT	3.5U	--	--	20	--	--	--
Gamma-chlordane/2	1.8U	--	--	10	--	--	--
Endrin Ketone	3.5U	--	--	1.9J	--	--	--
Alpha-Chlordane /2	1.8U	--	--	14 N	--	--	--

Notes:

µg/kg Micrograms per kilogram
JS Jordan Sign Company
SS Surface soil sample
U Constituent analyzed for but not detected; value reported is the sample quantitation limit.
J Estimated value
-- Constituent analyzed for but not detected.
N Presumptive evidence of presence of material
Shaded areas indicate elevated concentrations of constituents

and gamma-chlordane/2.

5.0 PATHWAYS

This section discusses the groundwater migration, surface water migration, soil exposure, and air migration pathways. Additionally, this section discusses the targets associated with each pathway and draws pathway-specific conclusions. Sampling locations and analytical results for samples collected from the specific pathways are also discussed.

5.1 GROUNDWATER MIGRATION PATHWAY

Eleven groundwater samples were collected during the ESI. Sampling locations are depicted on Figure 3 and described in Table 3. Tetra Tech personnel installed and sampled three temporary monitoring wells; also sampled were four permanent monitoring wells, one supply well, and three drinking water wells maintained by the City of Savannah Water & Sewer Bureau (Ref. 6). Field parameters for groundwater samples are presented in Table 10. Inorganic analytical results for drinking water wells maintained by the City of Savannah are presented in Table 11. Temporary and monitoring well inorganic and organic analytical results are summarized in Tables 12 and 13, respectively. Tables 10, 11, 12, and 13 are presented following Section 5.1.2.

5.1.1 Geologic and Hydrogeologic Setting

Chatham County is located on the upper Georgia coast and extends to a maximum of 50 miles inland. The terrain is mostly level, and much of the area near the coast is marshy. The climate is influenced considerably by the coastal location and the subtropical latitude (Ref. 12, p. 67). The soil type at the landfill is classified as fresh tidal marsh. A fresh tidal marsh is adjacent to major fresh water streams. It occurs in the upper reaches of the marshland belt and is influenced by the daily tides. The soil material varies from place to place. The surface layer is a black or dark grayish-brown silty clay loam that contains many roots. Underneath the surface layer is a grayish-brown to black, soft, clayey material that has decaying logs, roots, and stumps intermixed. In some areas there are thin lenses of sand, and in other areas sandy material occurs at a depth of 3 to 8 feet (Ref. 12, p. 35).

The landfill is located in the coastal lowlands topographic division of the Coastal Plain physiographic province of Georgia. The terrain in the coastal lowlands consists of barrier islands, marshes, level plains and a series of terraces. Elevations in the coastal lowlands range from sea level to 100 feet above mean sea level (msl) (Refs. 1; 19).

The geologic units that underlie the landfill, listed in descending stratigraphic order, include

unconsolidated post-Miocene age deposits, the Hawthorn Group, the Suwannee Limestone, the Cooper Formation, the Ocala Limestone, the Gosport Sand equivalent, the Lisbon Formation, and the Tallahatta Formation. The unconsolidated post-Miocene deposits are composed of sand, gravel, clay, and marl and range from 50 to 100 feet thick in the landfill area. The Hawthorn Group is approximately 100 feet thick and consists of marl, clay, sand, and dolomite interbedded with phosphatic sandy clay and sandy dolomite. The Suwannee Limestone is approximately 80 feet thick and ranges from a fossiliferous limestone to a dense calcitized unfossiliferous limestone. The Cooper Formation consists of a phosphatic sandy marl. The Ocala Limestone consists of a fossiliferous, recrystallized, pourous limestone containing large solution cavities. The combined thickness of the Cooper Formation and Ocala Limestone is approximately 350 feet. The Gosport Sand equivalent consists of calcareous sand or sandy limestone that is glauconitic at depth. The Lisbon Formation consists of glauconitic, sandy, clayey, and fossiliferous marl. The Tallahatta Formation is interbedded glauconitic sand and shale that grades to glauconitic argrillaceous and sandy fossiliferous limestone. The combined thickness of the Gosport Sand equivalent, the Lisbon Formation and the Tallahatta Formation ranges from 500 to 600 feet (Refs. 19, p. D24; 20).

Two major aquifers occur in the Savannah area: a surficial aquifer system and the Floridan Aquifer system. The surficial aquifer system is composed of the unconsolidated post-Miocene-age deposits. The underlying Floridan Aquifer system is primarily composed of carbonate units that range from Oligocene to middle Eocene age. In the Savannah area, the surficial aquifer is separated from the Floridan Aquifer system by the confining units of the Hawthorn Group (Refs. 19, pp. D18, D23; 21, p. 23).

Groundwater in the surficial aquifer is generally under unconfined conditions. The water level in this aquifer fluctuates seasonally, corresponding to seasonal variation in precipitation and evaporation. The surficial aquifer is recharged by infiltration of rainwater, generally in correlation with water from lakes, streams, and marshes (Ref. 19, p. D18).

The top of the Floridan Aquifer system occurs approximately 150 feet bls in the Savannah area. The Floridan Aquifer system can be divided into upper and lower permeable zones referred to as the Upper and Lower Floridan Aquifers. The Upper and Lower Floridan Aquifers are separated by a middle Eocene-age confining unit. The Floridan Aquifer system is confined below the low-permeability beds that occur in the middle of the Lisbon Formation. The Upper Floridan Aquifer consists of permeable beds of the Suwannee Limestone, Cooper Formation, and the Ocala Limestone. The Upper Floridan Aquifer is approximately 500 to 600 feet thick. In the Savannah area, the Upper Floridan Aquifer consists primarily of three permeable zones separated by locally confining units. The Lower Floridan Aquifer consists of permeable beds in the Gosport Sand equivalent and part of the Lisbon Formation. The Lower Floridan Aquifer is approximately 200 feet thick. In the site area, the Lower Floridan Aquifer responds to pumping from the Upper Floridan Aquifer. This response is indicated by the similarity, over

time, of water levels observed in the Upper and Lower Floridan Aquifers. This suggests that the Upper and Lower Floridan aquifers are hydrologically connected in the area (Refs. 20; 21).

5.1.2 Groundwater Sampling Locations and Analytical Results

Eleven groundwater samples were collected during the ESI (see Figure 3). Four groundwater samples were collected from on-site permanent monitoring wells, three samples were collected from temporary monitoring wells, three samples were collected from the Savannah Water & Sewer Bureau municipal wells, and one sample was collected from a supply well at the Savannah Country Club. The permanent monitoring wells are screened in the surficial aquifer, and the temporary wells installed during the ESI sampling activities were also screened in the surficial aquifer (Refs. 6; 17 , Appendix II). Two background groundwater samples were collected due to the differences in depths of the municipal wells and the temporary and permanent monitoring wells on site. Background temporary monitoring well sample JS-01-GW was collected in a wooded area approximately 100 feet north of East President Street Extension, and 75 feet west of Dulany Road. The second background sample JS-01-PW, was collected from the Savannah Country Club private well upgradient of site influences; and the well is 480 feet deep and screened in the Floridan Aquifer. The Savannah Water & Sewer Bureau municipal wells are also screened in the Floridan Aquifer (Refs. 6; 22; 23). Groundwater samples JS-08-DW, JS-11-DW, and JS-16-DW were collected from City of Savannah Water & Sewer Bureua municipal wells located immediately east and southeast of the landfill. One of these wells (well 11) is located within 0.50 mile of the landfill (Refs. 1; 6; 22; 23; 24) .

Arsenic, cadmium, lead, mercury, and zinc were detected at elevated levels in groundwater samples collected on site. Arsenic was detected at an elevated concentration of 730 micrograms per liter (µg/L) in groundwater sample JS-01A-MW. Cadmium was detected at an elevated concentration of 0.40J µg/L in groundwater sample JS-01A-MW. Lead was detected at elevated concentration of 49J µg/L in groundwater sample JS-05A-MW. Mercury was detected at a elevated concentration of 1.0J µg/L in groundwater sample JS-03-GW. Zinc was detected at elevated concentrations ranging from 93J µg/L in groundwater sample JS-05A-MW to 760J µg/L in sample JS-01A-MW. In addition, arsenic, lead, and zinc were detected in the municipal well samples; but, not at elevated concentrations (see Table 12).

Caprolactam and gamma-chordane/2 are the only organic constituents detected at elevated levels in on-site groundwater samples (see Table 13). Numerous miscellaneous organic componds were detected in the on-site groundwater samples. No organic compounds were detected at elevated concentrations in the municipal well samples (see Appendix A).

5.1.3 Groundwater Targets

Drinking water within a 4-mile radius of the landfill is obtained from municipal groundwater wells maintained by the Savannah Water & Sewer Bureau, the town of Thunderbolt Water System, and several small community systems (1; 22; 23; 24; 25). The City of Savannah and Thunderbolt municipal water supply is derived from wells that draw water from the Floridan Aquifer system. The City of Savannah Water & Sewer Bureau supplies water in a blended system from a total of 38 wells drilled approximately 450 feet into the Floridan Aquifer located throughout the greater Savannah area (Ref. 25). The Savannah Water & Sewer Bureau provides potable water to 68,425 connections, or approximately 189,161 people, through seven individual systems: Savannah Main (22 wells), Dutch Island (3 wells), Georgetown/Gateway (4 wells), Savannah Quarters (2 wells), Travis (3 wells), Whitemarsh Island (3 wells), and Wilmington Island (4 wells) (Refs. 1; 22; 23; 24; 25). Of the seven systems, wells for two of the systems are located within 4 miles of the site: Savannah Main (13 wells serving 92,222 persons) and Whitemarsh Island (1 well serving 1,163 persons). The water in these individual systems is blended prior to distribution, and is also distributed within each individual system. The nearest municipal well to the site (Savannah Main) is located within 0.50 mile southeast of the landfill (Refs. 1; 22; 23; 24; 25; 26).

The City of Thunderbolt maintains two municipal wells approximately 3.5 miles southeast of the site. Water from these wells is blended prior to distribution. These wells are located approximatley 3.5 miles southeast of the site. Combined, these wells serve a total of 1,200 connections or approximately 3,108 persons (Refs. 1; 22; 23; 24; 25; 26).

No known private residences in the Savannah area obtain potable water from private wells that are completed in the surficial aquifer (Ref. 22). A total of approximately 96,493 people living within 4 miles of the landfill obtain potable water from public wells completed in the Floridan Aquifer system (Ref. 25). Table 14 provides a breakdown of the public drinking water well locations within 4 miles of the landfill and the number of people served by these wells.

TABLE 10

SUMMARY OF FIELD PARAMETERS
GROUNDWATER SAMPLES

SampleLocation	Well Depth (ft)	Final Field Parameters			
		pH	Conductivity	Temperature (°C)	Turbity (NTU)
JS-01-GW	3	6.23	3.37	16.1	9
JS-01A-MW	15.5	6.57	1.24	16.4	0
JS-02A-MW	12.2	7.38	1.48	15.4	0
JS-02-MW	12	7.00	0.077	13.4	85
JS-03-GW	3	NR	NR	NR	NR
JS-05-GW	6	7.03	0.208	16.8	6
JS-05A-MW	19	7.21	1.70	16.5	0
JS-01-PW	480	8.65	0.227	17.2	0
JS–08-DW	587	7.95	0.264	22.5	0
JS-11-DW	714	8.0	0.254	22.0	0
JS-16-DW	551	8.05	0.234	22.0	0

Notes:

ft	Feet
°C	Degrees Celcius
NTU	Nephelometric Turbity Unit
JS	Jordan Sign Company.
NR	Not recorded
DW	Municipal well
GW	Temporary well
MW	Monitoring well
PW	Private well

TABLE 11

SUMMARY OF INORGANIC ANALYTICAL RESULTS
POTABLE GROUNDWATER SAMPLES

ANALYTE (µg/L)	SAMPLE NUMBER			
	Savannah Country Club Well	Savannah Water & Sewer Bureau Wells		
	JS-01-PW	JS-08-DW	JS-11-DW	JS-16-DW
Arsenic	5.6U	2.4A	1.2	1.4
Barium	13	14A	12	14
Cadmium	0.40J	--	--	--
Calcium	27,000	29A	24	24
Iron	20U	--	0.57	0.17
Lead	1.6UR	--	1.5	--
Magnesium	8,300	8.7A	8.9	8.9
Mercury	0.10J	--	--	--
Potassium	1,400J	2.1A	2.0	1.8
Strontium	NA	340A	370	380
Sodium	9,500	12A	12	8.4
Zinc	26 J	7.4 A	31	26

Notes:

µg/L	Microgram per liter	A	Average Value
JS	Jordan Sign Company	NA	Not Analyzed
DW	Municipal well groundwater sample	R	Unusable Data
PW	Private well groundwater sample		
J	Estimated value		
U	Constituent analyzed for but not detected; value reported is the sample quantitation limit		
--	Constituent analyzed for but not detected		

TABLE 12

SUMMARY OF INORGANIC ANALYTICAL RESULTS
GROUNDWATER SAMPLES

	SAMPLE NUMBER						
	Background	On Site					
ANALYTE (µg/L)	JS-01-GW	JS-01A-MW	JS-02A-MW	JS-02-MW	JS-03-GW	JS-05-GW	JS-05A-MW
Aluminum	3,000J	4,900J	--	380J	3,200J	1,200J	2,400J
Arsenic	16U	730	--	--	--	--	--
Barium	160	50	120	12	50	9.1	170
Cadmium	0.40UJ	0.40J	--	--	--	--	--
Calcium	92,000	150,000	240,000	17,000	510,000	37,000	280,000
Iron	57,000	23,000	7,000	2,100	13,000	2,000	17,000
Lead	4.3J	--	3.8J	--	5.0J	--	49J
Magnesium	62,000	14,000	15,000	1,400	34,000	1,800	24,000
Manganese	1,100	780J	930	56	960	--	810J
Mercury	0.10UJ	--	--	--	1.0J	--	--
Potassium	18,000J	13,000J	9,300J	970J	36,000J	550J	15,000J
Sodium	430,000	96,000	65,000	2,400	120,000	3,200	110,000
Zinc	25J	760J	100J	30J	170J	--	93J

Notes:

~~mg/kg~~	~~Milligrams per kilogram~~ ug/L ?
JS	Jordan Sign Company
GW	Temporary well groundwater sample
MW	Permanent monitoring well groundwater sample
U	Constituent analyzed for but not detected; value reported is the sample quantitation limit.
J	Estimated value
--	Constituent analyzed for but not detected
N	Presumptive evidence of presence of material
N/A	Not analyzed
	Shaded areas indicate elevated concentrations of constituents

TABLE 13

SUMMARY OF ORGANIC ANALYTICAL RESULTS
GROUNDWATER SAMPLES

	SAMPLE NUMBER						
	Background	On Site					
ANALYTE (µg/L)	JS-01-GW	JS-01A-MW	JS-02A-MW	JS-02-MW	JS-03-GW	JS-05-GW	JS-05A-MW
Volatiles							
None							
Extractables							
Caprolactam	18	300	39	120	--	--	210
Pesticides/PCBs							
Endosulfan I (Alpha)	0.050UJ	--	0.020JN	--	--	--	--
4,4'-DDD	0.10U	--	0.052J	--	--	--	--
4,4'-DDE	0.10U	--	0.026JN	--	--	--	--
Gamma-Chlordane/2	0.050U	--	0.59	--	--	--	--

Notes

µg/L	~~Milligrams~~ micrograms per liter
JS	Jordan Sign Company
U	Constituent analyzed for but not detected; value reported is the sample quantitation limit
J	Estimated value
--	Constituent analyzed for but not detected
N	Presumptive evidence of presence of material
	Shaded areas indicate elevated concentrations of constituents
PCB	Polychlorinated biphenyl
GW	Temporary well groundwater sample
MW	Permanent monitoring well groundwater sample

TABLE 14

FLORIDAN AQUIFER SYSTEM
DRINKING WATER WELLS AND POPULATION SERVED

Radial Distance	Public Wellfield	Number of Public Wells	People Served per Wellfield *	Total People Served
0 - 0.25 mile	-	-	-	-
0.25 - 0.5 mile	Sav (Main)	1	7,094	7,094
0.50 - 1 mile	Sav (Main)	2	7,094	14,188
1 - 2 miles	Sav (Main)	2	7,094	14,188
2 - 3 miles	Sav (Main) Thunderbolt	4 2	7,094 3,108	31,484
3 - 4 miles	Sav (Main) Sav (Whitemarsh)	4 1	7,094 1,163	29,539
			Total	96,493

Notes:

Sav = Savannah Water & Sewer Bureau

* Savannah (Main): Serves 156,072 people via 22 wells;
156,072/22 wells = 7,094 people/well

* Savannah (Whitemarsh): Serves 3,489 people via 3 wells;
3,489/3 wells = 1,163 people/well

* Thunderbolt: Serves 1,200 connections via 2 wells;
1,200 x 2.59 (Chatham County persons per household) = 3,108 persons served

5.1.4 Groundwater Conclusions

The groundwater migration pathway is of some concern at the landfill. Although groundwater samples collected from on-site temporary and permanent monitoring wells during the ESI indicated the presence of arsenic, cadmium, lead, mercury, zinc, and gamma-chlordane/2 at elevated concentrations, no known targets within a 4-mile radius of the landfill obtain potable drinking water from the surficial aquifer. Furthermore, in the Savannah area the surficial aquifer is separated from the Floridan Aquifer system by confining beds of the Hawthorn Group.

The groundwater migration pathway is of some concern due to the presence of numerous municipal wells within 4 miles of the landfill. However, no inorganic or organic constituents of concern were detected at elevated levels in the groundwater samples collected from the three City of Savannah Water & Sewer Bureau municipal wells completed in the Floridan Aquifer. In addition, approximately 96,493 persons obtain water from wells within a 4-mile radius of the landfill, with the nearest municipal well located within 0.50 mile of the landfill.

5.2 SURFACE WATER MIGRATION PATHWAY

Tetra Tech personnel collected six surface water and six sediment samples during the ESI. Surface water and sediment sampling locations are depicted on Figure 3 and described in Tables 4 and 5. Inorganic and organic analytical results for surface water samples are summarized in Tables 15 and 16, respectively. Inorganic and organic analytical results for sediment samples are summarized in Tables 17 and 18, respectively. Tables 15 through 18 are presented following Section 5.2.4.

5.2.1 Hydrologic Setting

Surface water runoff at the facility enters a storm water drainage ditch located between the East President Street Extension, and the southern edge fo the the facility property. This drainage ditch traverses the entire southern portion of the landfill property and drains into the Kayton Canal located approximately 100 feet west of the landfill (Ref. 6) (see Figure 2). The natural gradient for theKayton Canal is north to the Savannah River, located 0.25 mile north of the landfill (Refs. 1; 27). However, the Savannah Water & Sewer Bureau maintains a wastewater pump station on the northern end of the Kayton Canal, to regulate flow of the canal. The pump station prevents the flow from the canal from flowing into the Savannah River naturally. At times, there is no flow in the canal, and the canal characteristics are more like a pond or lake. If the water level in the canal is high, the water is pumped to the wastewater pump station, and then discharged to the Savannah River. In addition, there are tide gates at the wastewater pump station on the Savannah River; at times the tide gates do not function properly, resulting in salt water intrusion into the Kayton Canal (Ref. 27).

5.2.2 Surface Water and Sediment Sampling Locations and Analytical Results

Tetra Tech personnel collected six surface water and six sediment samples during the ESI. Background surface water and sediment samples JS-01-SW and JS-01-SD were collected from the storm water ditch upstream of the landfill. Control surface water and sediment sample JS-06-SW and JS-06-SD were collected from the Kayton Canal adjacent to the former Savannah Water & Sewer Bureau outfall on the Kayton Canal.

Inorganic constituents detected at elevated levels in surface water and sediment samples collected during the ESI include aluminum, barium, cadmium, and silver. Inorganic constituents of concern detected at elevated levels in sediment samples collected during the ESI include aluminum, arsenic, chromium, copper, lead, mercury, silver, vanadium, and zinc. Aluminum was detected at an elevated concentration of 1,800 µg/L in surface water sample JS-02-SW, and 14,000J mg/kg in sediment sample JS-05-SD. Arsenic was detected at an elevated concentration of 76 mg/kg in sediment sample JS-05-SD. Barium was detected at an elevated concentration of 60 µg/L in surface water sample JS-04-SW. Cadmium was detected at an elevated concentration of 0.40J µg/L in surface water sample JS-03-SW. Chromium was detected at an elevated concentration of 31 mg/kg in sediment sample JS-05-SD. Lead was detected in two sediment samples at elevated concentrations of 240 mg/kg in sample JS-02-SD and 280 mg/kg in sample JS-05-SD. Mercury was detected in three sediment samples at elevated concentrations of 0.18 mg/kg in sample
JS-04-SD and 0.97 mg/kg in sample JS-05-SD. Silver was detected at elevated concentration of 20 µg/L in surface water sample JS-02-SW. Silver was also detected in three sediment samples at elevated concentrations ranging from 32J mg/kg in sediment sample JS-04-SD to 130J mg/kg in sample JS-02-SD. Vanadium was detected at an elevated concentration of 46 mg/kg in sediment sample JS-05-SD.

Organic compounds detected at elevated concentrations in surface water samples collected during the ESI include chloroform and atrazine (see Table 16). Organic compounds detected at elevated concentrations in sediment samples collected during the ESI include include fluoranthene, phenanthrene, pyrene, benzo(a)anthracene, chrysene, bis(2-ethylhexyl phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(ghi)perylene, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, gamma-chlordane/2, and PCB-1260. Fluoranthene was detected at an elevated concentration of 7,400 mg/kg in sediment sample JS-05-SD. Phenanthrene was detected at an elevated concentration of 5,100 µg/kg in sediment sample JS-05-SD . Anthracene was detected at an elevated concentration of 1,200 µg/kg in sample JS-05-SD. Pyrene was detected at an elevated concentration of 7,400J µg/kg in sample JS-05-SD. Benzo(a)anthracene was detected at an elevated concentration of 3,100 µg/kg in sample JS-05-SD. Chrysene was detected at an elevated concentration of 2,900 µg/kg in sample JS-05-SD. Bis(2-ethyhexyl)phthalate was detected at an elevated concentration of 1,300 µg/kg in sample JS-04-SD. Benzo(b)fluoranthene was detected at an elevated concentration of 2,300 µg/kg in sample JS-

SD. Bis(2-ethyhexyl)phthalate was detected at an elevated concentration of 1,300 µg/kg in sample JS-04-SD. Benzo(b)fluoranthene was detected at an elevated concentration of 2,300 µg/kg in sample JS-05-SD. Benzo(k)fluoranthene was detected at an elevated concentration of 2,200 µg/kg in sample JS-05-SD. Benzo-a-pyrene was detected at an elevated concentration of 2,400 µg/kg in sample JS-05-SD. Indeno(1,2,3-cd)pyrene was detected at an elevated concentration of 1,900 µg/kg in sample JS-05-SD. Dibenzo(a,h)anthracene was detected at an elevated concentration of 790 J µg.kg in sample JS-05-SD. Benzo(ghi)perylene was detected in two sediment samples at elevated concentrations of 250J µg/kg in sediment sample JS-04-SD to 820J µg/kg in sample JS-05-SD. 4,4'-DDE was detected at an elevated concentration of 67 µg/kg in sample JS-05-SD.
4,4'-DDD was detected at an elevated concentration of 13 µg/kg in sample JS-05-SD. 4,4'-DDT was detected at an elevated concentration of 84 µg/kg in sample JS-05-SD. Gamma-chlordane/2 was detected at an elevated concentration of 22 µg/kg in sample JS-05-SD. PCB-1260 was detected at an elevated concentration of 63 µg/kg in sample JS-05-SD.

5.2.3 Surface Water Targets

The Jordan Sign Company property is situated on approximately 20 acres of land classified as Palustrine scrub-shrub wetlands. In addition, approximately 0.25 mile of Palustrine scrub-shrub wetlands are located along the east bank of the Kayton Canal (Ref. 28). No surface water intakes are located on the Kayton Canal. The Kayton Canal is used for recreational fishing (Refs. 29; 30).

5.2.4 Surface Water Conclusions

The surface water migration pathway is a major concern at the Jordan Sign Company site. Elevated levels of inorganic constituents of concern detected in surface water samples collected during the ESI include aluminum, barium, cadmium, and silver. Elevated levels of inorganic constituents of concern detected in sediment samples collected during the ESI include aluminum, arsenic, chromium, copper, lead, mercury, silver, vanadium, and zinc. Organic compounds detected at elevated concentrations in surface water samples collected during the ESI include atrazine and chloroform. Organic compounds detected at elevated concentrations in sediment samples collected during the ESI include fluoranthene, phenanthrene, pyrene, benzo(a)anthracene, chrysene,bis(2-ethylhexyl phthalate, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene,indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(ghi)perylene, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, gamma-chlordane/2, and PCB-1260; the presence of these chemicals constitute an observed release of hazardous substances to the Kayton Canal which is utilized for recreational purposes, including fishing. An observed release of hazardous substances was also documented to the on-site palustrine scrub-shrub wetlands and the palustrine scrub-shrub wetlands located along the Kayton Canal.

TABLE 15
SUMMARY OF INORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES

ANALYTE (µg/L)	SAMPLE NUMBER					
	Background	Stormwater Ditch		Control	Kayton Canal	
	JS-01-SW	JS-02-SW	JS-03-SW	JS-06-SW	JS-04-SW	JS-05-SW
Aluminum	290J	1,800J	--	830J	780J	730J
Barium	100	170	130	21	60	26
Cadmium	0.40UJ	--	0.40J	0.40J	--	--
Calcium	68,000	110,000	160,000	51,000	88,000	55,000
Iron	1,600	4,500	870	1,200	1,500	970
Lead	1.6UR	53J	--	8.3J	11J	5.8J
Magnesium	4,000	8,200	12,000	38,000	26,000	37,000
Manganese	92	170J	230	150	170	170J
Potassium	4,600J	4,600J	5,400J	18,000J	12,000J	18,000J
Silver	1.0U	20	--	0.74U	--	--
Sodium	15,000	17,000	24,000	250,000	150,000	240,000
Zinc	56J	160J	--	72J	58J	64J

Notes:
- µg/L — Micrograms per liter
- JS — Jordan Sign Company
- SW — Surface water
- U — Constituent analyzed for but not detected; value reported is the sample quantitation limit
- J — Estimated value
- R — Data Unusable

TABLE 16

SUMMARY OF ORGANIC ANALYTICAL RESULTS
SURFACE WATER SAMPLES

	SAMPLE NUMBER					
	Background	Stormwater Ditch		Control	Kayton Canal	
ANALYTE (µg/L)	JS-01-SW	JS-02-SW	JS-03-SW	JS-06-SW	JS-04-SW	JS-05-SW
Volatiles						
Chloroform	1.0U	--	--	1.0U	--	1.2
Extractables						
Atrazine	5 J	5 J	5 J	5 J	110J	--
Pesticides/PCBs						
None						

Notes:

µg/L	Micrograms per liter
JS	Jordan Sign Company
SW	Surface water sample
U	Constituent analyzed for but not detected; value reported is the sample quantitation limit (SQL)
J	Estimated value
--	Constituent analyzed for but not detected.
	Shaded areas indicate elevated concentrations of constituents
PCB	Polychlorinated biphenyl

TABLE 17
SUMMARY OF INORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES

ANALYTE (mg/kg)	SAMPLE NUMBER					
	Background	Stormwater Ditch		Control	Kayton Canal	
	JS-01-SD	JS-02-SD	JS-03-SD	JS-06-SD	JS-04-SD	JS-05-SD
Aluminum	4,900J	8,100J	5,200J	2,800J	2,900J	14,000J
Arsenic	8.4U	--	--	7.0U	--	76
Barium	60	110	56	26	36	95
Calcium	12,000	8,900	4,600	7,000	1,700	2,200
Chromium	16	36	15	7.9	10	31
Copper	31	80	22	21	25	120
Iron	8,100	15,000	7,200	5,100	4,700	16,000
Lead	46	240	61	51	62	280
Magnesium	1,100	1,200	970	1,300	610	1,700
Manganese	120	130	77	62	31	80
Total Mercury	0.09U	0.26	--	0.10U	0.18	0.97
Potassium	460J	290J	370J	290J	200J	720J
Silver	7.7UJ	130J	22J	1.3UJ	32J	--
Sodium	280	340	210	360	360	790
Vanadium	27	35	21	8.7U	--	46
Zinc	200	270	120	100	110	160
Cyanide	0.28U	--	--	0.23U	2.0	--

Notes:
- mg/kg — Milligrams per kilogram
- JS — Jordan Sign Company
- SD — Sediment
- U — Constituent analyzed for but not detected; value reported is the sample quantitation limit
- J — Estimated value

TABLE 18
SUMMARY OF ORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES

	SAMPLE NUMBER					
	Background	Stormwater Ditch		Control	Kayton Canal	
ANALYTE (ug/kg)	JS-01-SD	JS-02-SD	JS-03-SD	JS-06-SD	JS-04-SD	JS-05-SD
Volatiles						
Methyl Acetate	2J	--	4J	6J	--	--
Methyl Ethyl Ketone	15U	--	22J	13U	--	--
Extractables						
Phenol	510U	--	140J	440U	--	--
(3-and/or4-)Methylphenol	510U	--	350J	440U	--	--
Napththalene	510U	--	--	440U	--	91J
2-Methylnaphthalene	510U	--	--	440U	--	110J
Acenaphthylene	510U	--	--	440U	--	320J
Acenaphthene	510U	--	--	440U	--	200J
Dibenzofuran	510U	--	--	440U	--	190J
Fluorene	510U	--	--	440U	--	250J
Fluoranthene	100J	240J	160J	180J	260J	7,400
Phenanthrene	510U	92J	--	63J	100J	5,100
Anthracene	510U	--	--	440U	--	1,200
Carbazole	510U	--	--	440U	--	280J
Pyrene	100J	250J	160J	160J	260J	7,400J
Benzo(a)anthracene	510U	110J	86J	76J	110J	3,100
Chrysene	90J	170J	120J	130J	160J	2,900
Bis(2-ethylhexyl)phthalate	510U	--	--	520U	1,300	--
Di-n-octylphthalate	510U	--	--	440U	1,400	--
Benzo(b)fluoranthene	80J	170J	140J	150J	130J	2,300
Beno(k)fluoranthene	62J	110J	110J	91J	150J	2,200
Benzo-a-Pyrene	58J	120J	100J	110J	130J	2,400
Indeno(1,2,3-cd)pyrene	72 J	130J	110J	120J	140J	1,900
Dibenzo(a,h)anthracene	510UJ	--	--	50J	--	790J
Benzo(ghi)perylene	52J	88J	75J	63J	250J	820J
Pesticides/PCBs						
Endosulfan I (Alpha)	2.6 UR	--	--	2.3UR	--	0.67J

TABLE 18 (CONTINUED)
SUMMARY OF ORGANIC ANALYTICAL RESULTS
SEDIMENT SAMPLES

	SAMPLE NUMBER					
	Background	Stormwater Ditch		Control	Kayton Canal	
ANALYTE (µg/kg)	JS-01-SD	JS-02-SD	JS-03-SD	JS-06-SD	JS-04-SD	JS-05-SD
Dieldrin	5.1U	--	--	4.4U	--	19N
4,4'-DDE	1.4J	3.4JN	4.3J	3.4J	4.7JN	67
4,4'-DDD	5.1U	2.2J	5.6 JN	2.1J	5.0J	13
4,4'-DDT	5.1U	--	--	4.4U	--	84
Alpha-Chlordane/2	2.6U	2.2JN	2.8J	4.2N	8.0N	--
Gamma-Chlordane/2	2.6U	1.7J	1.8 J	2.3U	6.5N	22
PCB-1254	51U	--	--	44	--	--
PCB-1260	51U	--	--	44U	--	63

Notes:

µg/kg	Micrograms per kilogram
JS	Jordan Sign Company
SD	Sediment sample
U	Constituent analyzed for but not detected; value reported is the sample quantitation limit.
J	Estimated value
--	Constituent analyzed for but not detected.
N	Presumptive evidence of presence of material
	Shaded areas indicate elevated concentrations of constituents
PCB	Polychlorinated biphenyl
R	Data Unusable

5.3 SOIL EXPOSURE PATHWAY AND AIR MIGRATION PATHWAY

During the ESI, Tetra Tech personnel collected six surface soil, and six subsurface soil samples from the landfill property. ESI surface soil and subsurface soil sampling locations are described in Tables 1 and 2 and are shown on Figure 3. Surface soil inorganic and organic analytical results are summarized in Tables 6 and 7, respectively. Subsurface soil inorganic and organic samples are summarized in Tables 8 and 9, repsectively. Tables 6, 7, 8, and 9 are presented following Section 4.1.

5.3.1 Physical Conditions

The land use surrounding the landfill is commercial and industrial (Ref. 1). The Southern States Phosphate and Fertilizer facility is located to the east-northeast portion of the landfill. Ind Chem, Inc. is located adjacent to the southeast corner of the landfill. The Savannah Country Club and golf course is located immediately southeast of the landfill across the East President Street Extension. Dulany Road borders the landfill property on both the west and north. Located west of Dulany Road is a wooded area situated on the east bank of the Kayton Canal. The area directly south of the landfill property is a low lying swampy area that also borders the Kayton Canal (Refs. 1; 5; 6; 27). Although the facility is partially fenced, the property is accessible to the public (Ref. 6).

5.3.2 Soil and Air Sample Locations and Analytical Results

On-site surface and subsurface soil sampling locations and analytical results are described in Tables 1 and 2, and discussed in Section 4.1.

5.3.3 Soil and Air Targets

The soil exposure pathway is of some concern at the landfill. Access to the landfill property is partially restricted by fences. There are no on-site workers (Ref. 6). The nearest residential areas are located approximately 0.5 mile southeast of the landfill (Ref. 1). Two schools are located approximately 1 mile south of the landfill property (Ref. 1). The population within 1 radial mile of the landfill is 4,529 people (Ref. 31).

The landfill is located in a moderately populated area; the number of people residing within a 4-mile radius of the landfill is distributed as follows: 0 to 0.25 mile, 0 persons; 0.25 to 0.5 mile, 140 persons; 0.5 to 1 mile, 4,389 persons; 1 to 2 miles, 27,115 persons; 2 to 3 miles, 26,461 persons; and 3 to 4 miles, 30,513 persons (Ref. 31). Several federally designated endangered and threatened species inhabit this part of Georgia; however, specific habitat locations are not known (Ref. 32).

5.3.4 Soil and Air Conclusions

The soil exposure pathway is of some concern at the landfill. The inactive landfill is situated in a mixed industrtial and commercial area of Savannah. Inorganic and organic constituents have been detected at elevated levels in samples collected from the landfill property. However, no air samples have been collected. The air migration pathway is of minimal concern due to the limited targets within a 4-mile radius of the facility.

6.0 SUMMARY AND CONCLUSIONS

The Jordan Sign Company property consists of an inactive landfill encompassing approximately 24.38 acres. Source areas evaluated at the site include the former landfill. Analytical results for on-site surface and subsurface soil samples indicated the presence of inorganic and organic contaminants including aluminum, arsenic, barium, cadmium, cobalt, chromium, copper, lead, manganese, mercury, nickel, silver, vanadium, zinc, acetone, dieldrin, heptachlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, gamma-chlordane/2, PCB-1254, and PCB-1260.

The groundwater migration pathway is a significant concern at the Jordan Sign Company site. Although arsenic, lead, mercury, and zinc are inorganic constituents of concern detected at elevated levels in groundwater samples collected from on-site temporary and permanent monitoring wells, and gamma-chlordane/2 was detected at an elevated level in an on-site groundwater sample, no known targets located within a 4-mile readius of the landfill obtain potable drinking water from the surficial aquifer. Furthermore, in the Savannah area the surficial aquifer is separated from the Floridan Aquifer system by confining beds of the Hawthorn Group.

The groundwater migration pathway is of some concern due to the presence of numerous municipal wells within 4 miles of the landfill. However, no inorganic or organic constituents of concern were detected at elevated levels in the groundwater samples collected from the three City of Savannah Water & Sewer Bureau municipal wells completed in the Floridan Aquifer. In addition, approximately 96,493 people obtain water from wells within a 4-mile radius of the landfill; with the nearest well located within 0.50 mile of the landfill.

The surface water migration pathway is also a major concern at the Jordan Sign Company site. Inorganic contaminants detected at elevated concentrations in surface water and sediment samples collected at the landfill and downstream of the landfill include aluminum, arsenic, barium, cadmium, chromium, copper, lead, mercury, silver, vanadium, and zinc. Organic contaminants detected at elevated concentrations in sediment samples collected at the landfill and downstream of the landfill include fluoranthene, phenanthrene, pyrene, benzo(a)anthracene, chrysene, bis(2-ethyhexyl phthalate, benzo(b)fluoranthene,

benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(ghi)perylene, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, gamma-chlordane/2, and PCB-1260, constituting an observed release of hazardous substances to the Kayton Canal which is utilized for recreational purposes, including fishing. An observed release of hazardous substances was also documented on the on-site palustrine scrub-shrub wetlands and the palustrine scrub-shrub wetlands located along the Kayton Canal.

The soil exposure pathway is of some concern. Both inorganic and organic constituents have been detected at elevated levels in soil samples collected on the landfill property. The area surrounding the Jordan Sign Company site is commercial and industrial. The Southern States Phosphate and Fertilizer facility is located adjacent to the east-northeast portion of the landfill. Ind Chem, Inc., is located adjacent to the southeast corner of the landfill. The Savannah Country Club and golf course is located immediately southeast of the landfill across the East President Street Extension. Dulany Road borders the landfill property on both the west and north. Located west of Dulany Road is a wooded area, situated on the east bank of the Kayton Canal. The nearest residential area is 0.50 mile southeast of the landfill. Two schools are located approximately 1 mile south of the landfill. The landfill property is partially fenced; therefore, the property is potentially accessible to local residents. The population within a 4-mile radius of the landfill is 88,618 people. The population within 1 radial mile of the landfill is 4,529 people. In addition, several federally designated endangered and threatened species inhabit this part of Georgia; however, specific habitat locations are not known.

Based on the analytical results of samples collected during the ESI, further action is recommended for the Jordan Sign Company site, including further characterization of the Kayton Canal.

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23. Tetra Tech EM Inc. Record of telephone conversation between David L. Brown, Environmental Scientist, and Mike Coon, Savannah Water Department. Subject: Water Systems Within the City of Savannah Water Operations. July 20, 2001.

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30. Tetra Tech EM Inc. Record of telephone conversation between David L. Brown, Environmental Scientist, and Shannon Wisness, Environmental Specialist III, GDNR EPD. Subject: Fishing in Kayton Canal. June 25, 2001.

31. M.F.Wendt, Information Specialist, Tetra Tech EM Inc., Project Note to File for Jordan Sign Company, Savannah, GA, July 12, 2001. Subject: Population within distance rings for Jordan Sign Company, Savannah, GA.

32. USFWS, Endangered and Threatened Species of the Southeastern United States, 1992.

In 1996, EPA's Science and Ecosystems Support Division (SESD) conducted a case development investigation, during which, soil, sediment, surface water, and groundwater samples were collected from the Southern States Phosphate & Fertilizer Company, and groundwater and a soil sample were collected from the "landfill", also known as the Jordan Sign Site. The subsurface soil sample collected from the landfill contained a variety of heavy metals contamination, including arsenic at a concentration of 15 mg/kg, exceeding the Region III risk based concentration (RBC) value for arsenic (3.8 mg/kg) by almost 400 percent.

With the proposed top layers of sand by CPV, the risk of exposure to contaminants in soil in the landfill are taken away; however, the transfer to groundwater is an unknown. We have not thoroughly characterized the contents of the landfill; therefore, it is not known what the highest concentrations of waste contaminants in the landfill are. Data from previous investigations of soils from the landfill are sparse. Here is a table of some of the data EPA found. There could be more data that we didn't include here:

Date	Type of Investigation	Contaminant / Concentration	~~Soil Sample Depth~~ media
11/96	EPA CDIE	arsenic / 15 mg/kg soil ars 33 mg/kg - LF downgrad	subsurface (don't know depth)

11/96 EPA CDIE
copper 1400 ug/L gw
lead 12 ug/L "
strontium 850 ug/L "
zinc 110 ug/L
Al 16 mg/L
Mn 3.5 mg/L

Cd 3.9 mg/kg center LF
Co 10 " "
Co 16 downgrad. LF
Cr 41 mg/kg center LF
Cr 74 — downgrad LF
Ni 68 LF - downgrad
18 center LF
lead 180 center LF, 72 downgr

Hg 200 ug/L - center
downgrad 140 ug/L

zinc

CASE DEVELOPMENT INVESTIGATION EVALUATION
SOUTHERN STATES PHOSPHATE & FERTILIZER CO.
SAVANNAH, GEORGIA
SESD PROJECT NO. 97-0033
NOVEMBER 1996

INTRODUCTION

During the week of November 4, 1996 the U.S. Environmental Protection Agency (US-EPA) Region 4, Science and Ecosystem Support Division (SESD), conducted a case development investigation and evaluation (DIE) at the Southern States Phosphate & Fertilizer Co. (S.P.) in Savannah, Georgia. The investigation was requested by the RCRA Enforcement and Compliance Branch (RCRA-ECB) and the Georgia Environmental Protection Division (GA-EPD) to evaluate potential releases from waste storage areas, a landfill, and an acid storage area. The study participants included:

Fred Sloan	US-EPA (SESD)
Art Masters	US-EPA (SESD)
Milton Henderson	US-EPA (SESD)
Shayla Beam	US-EPA (SESD)
Jack Dempsey	GA-EPD (Atlanta)
Greg Thomas	GA-EPD (Atlanta)

This investigation had multiple objectives. A waste pile was investigated to determine if the material was a hazardous waste, a former waste pile area was investigated to determine if a release had occurred, and a micronutrient pile was investigated to determine if it had originated from a hazardous waste (concentrated media samples). In addition, ponds and ditches were investigated to determine if a release had occurred (surface water and sediment samples). Finally groundwater and soil were was investigated to determine if a release had occurred in the area of one of the ponds, the sulfuric acid storage area, or the former landfill (soil and groundwater samples).

BACKGROUND

Fertilizer manufacturing has been done on the Southern States Phosphate & Fertilizer Co. site since 1903. Products manufactured have included granular fertilizer, sulfuric acid, super phosphate, and byproduct production of fluorosilic acid. Raw materials include sulfur phosphate rock, potassium salts,

nitrogen as ammonia, ammonium nitrate, and naturally occurring nitrate materials, limestone, inert filler materials, and secondary plant food materials. In the past iron pyrite was roasted on site in the manufacture of sulfuric acid. The use of pyrites was discontinued in the late 1920's (1).

SAMPLING AND ANALYSIS

A number of areas were investigated for this study, including ponds, piles, ditches, an old landfill, and some of the secondary plant food material.

Groundwater samples were collected from a control location, the old acid production (now the acid storage area), the east pond and the landfill. Surface soil samples were collected from all of these areas, and a subsurface soil sample was collected from below the cover of the landfill. Surface water and sediment samples were collected from four ponds on site, and three ditches. Samples were also collected from a former "Base A" storage area ("Base A" is spilled fertilizer material which is blended back into the process), a sulfur pile, and some of the secondary plant food material. All samples were analyzed for total metals and pH, and were evaluated for the possibility of failing the toxicity characteristic leaching procedure (TCLP). Samples containing toxicity characteristic (TC) constituents with concentrations greater than twenty times their regulatory levels were subjected to the TCLP test.

Because of past confusion in interpreting past groundwater data, it should be noted that care was taken to minimize turbidity in the groundwater samples to ensure the highest quality data. To this end, groundwater samples were collected with peristaltic pumps using low flow/low stress procedures.

DISCUSSION OF RESULTS

Previous investigations (1) have shown acid and lead contamination of the groundwater at this facility. The thirty-one samples collected for this investigation confirm the earlier results, and extend the base knowledge of the site. Analytical data is summarized in Tables 1 through 5. Raw data sheets are included in Appendix A.

The data summary tables include the corresponding relevant values from the US-EPA Region III risk-based concentration (RBC) tables, where appropriate. Region III keeps these values current on their web site:

URL http://www.epa.gov./reg3hwmd/risk

The following guidance for use of these RBC's is taken directly from the distribution memo (full text in Appendix B):

"RBCs also have several important limitations. Specifically excluded from consideration are (1) transfers from soil to air and groundwater, and (2) cumulative risk from multiple contaminants or media. Also, the toxicity information in the table has been assembled by hand, and (despite extensive checking and years of use) may contain errors.

Many users want to know if the risk-based concentrations can be used as valid no-action levels or cleanup levels, especially for soils. The answer is a bit complex. First, it is important to realize that the RBC table does not constitute regulation or guidance, and should not be viewed as a substitute for a site-specific risk assessment. For sites where:

1. A single medium is contaminated;

2. A single contaminant contributes nearly all of the health risk;

3. Volatilization or leaching of that contaminant from soil is expected not to be significant;

4. The exposure scenarios used in the RBC table are appropriate for the site;

5. The fixed risk levels used in the RBC table are appropriate for the site; and

6. Risk to ecological receptors is expected not to be significant;

The risk-based concentrations would probably be protective as no-action levels or cleanup goals. However, to the extent that a site deviates from this description, as most do, the RBCs would not necessarily be appropriate."

"To summarize, the table should generally not be used to (1) set cleanup or no-action levels at CERCLA sites or RCRA Corrective Action sites, (2) substitute for EPA guidance for preparing baseline risk assessments, or (3) determine if a waste is hazardous under RCRA."

These RBC values are included in this report solely to provide a context for the analytical data.

Groundwater Samples - Table 1

No groundwater samples contained TC constituents in concentrations that warranted performing the TCLP. Also, no groundwater samples had pH values of 2 standard units (SU) (or less) or 12.5 (SU) (or greater). However, two samples had low pH values, respectively, SS-013-GW (2.7 SU), collected downgradient of the old acid production area, and SS-016-GW (3.4 SU), collected downgradient of the east pond. As can be seen in Table 1, sample SS-010-GW (control) was the only sample collected that did not exceed Region III RBC screening values for tap water for one or more analytes. Analytes that exceeded the screening values were arsenic, cadmium, lead (no RBC value available, maximum contaminant level (mcl) value exceeded, zinc, aluminum, and manganese.

Soil Samples - Table 2

While TC constituents (lead and arsenic) were found in soil samples, TCLP results showed that none of the samples contained TC metals above their regular levels. Four of the six surface soil samples collected exceeded the Region III RBC value for arsenic (3.8 mg/kg, Table 2). The subsurface soil sample collected from the landfill also contained elevated levels of arsenic, 15 mg/kg. Two surface soil samples contained lead at levels above screening values. The value of 400 mg/kg given as the screening level in Table 2 is the concentration suggested by Region III and is the US-EPA Office of Solid Waste Directive recommended value for residential cleanups.

Surface Water Samples - Table 3

No suitable surface water control locations were noted during the investigation. Most on-site surface water originates from non-contact cooling water generated during the production of sulfuric acid.

No RBC values are yet published for surface water. It should be noted, however, that arsenic was detected in five of the seven surface water samples at concentrations ranging from 11 to 19 ug/l. In addition, lead was detected in four of the seven samples at concentrations ranging from 9.2 to 35 mg/l.

Sediment Samples - Table 4

While TC constituents (arsenic, lead, and antimony) were found in sediment samples, TCLP results showed that none of the samples contained TC metals above their regulated levels.

Also, no sediment samples had pH values of 2 standard units (SU) (or less) or 12.5 (SU) (or greater).

No RBC values are yet published for sediment. A large number of heavy metals were detected in these sediment samples, including arsenic, antimony, barium, cobalt, copper, nickel, lead and mercury. Arsenic was detected in six of the seven samples at concentrations ranging from 13 to 440 mg/kg. Lead was detected in all seven samples at concentrations from 210 to 1400 mg/kg.

Concentrated Media Samples - Table 5

Three samples were collected from various concentrated media at the facility. Analytical results showed that one sample exceeded the TC regulatory level (5 mg/l) for lead. TCLP results of sample SS-008-WA showed it to be a RCRA characteristic D008 waste for lead at 16 mg/l. This solid sample also had a pH of 1.4. This material was described as a waste sulfur pile, but visibly contained significant amounts of other materials. The pile is located on the bank of Holding Pond #1.

Analytical results of sample SS-007-WA showed that it contained 180 mg/kg of mercury. However TCLP results found SS-007-WA to contain 0.007 mg/l which is below the regulatory level of 0.2 mg/l.

CONCLUSIONS

Groundwater Samples - Relative to the control sample (SS-010-GW) it is apparent that releases of contaminants to groundwater have occurred in the acid storage area. In particular, concentrations of arsenic and lead are elevated in this area (along with other heavy metals). While this dataset cannot be definitive, it is possible that the elevated concentrations in the east pond control sample (SS-016-GW) may be due to releases in the acid storage area.

Soil Samples - Again, relative to the control sample (SS-010-SF), it is apparent that releases have occurred in the acid storage area. In particular, lead and arsenic are elevated (along with other heavy metals). Heavy metals were elevated in the other soil samples collected on-site, but not to the degree noted in the acid storage area.

Surface Water and Sediment Samples - No suitable on-site control locations existed for these media, but it is consistent with the groundwater and soil samples that arsenic and lead were

detected in these samples. Arsenic and lead are being released off-site to surface water and sediment via the ditch at the discharge end of pond #2. This study did not determine if this release is partially due to on-going activities, or solely to historical releases.

Concentrated Media - The soil sample collected from the former base "A" storage area contained elevated arsenic and lead (and other heavy metals) relative to the control soil sample (SS-010-SF). No suitable control exists for the No. 12 material. The analytical results for this sample (SS-007-WA) showed high levels of several heavy metals (lead, mercury, copper, mercury, etc.), but did not contain TC constituents above regulated levels. The sample collected from the sulfur pile (SS-008-WA) did contain lead above regulated levels (16 mg/kg in the TCLP extract).

METHODOLOGY

Groundwater samples were not collected from existing permanent wells, but were collected from temporary shallow well points. All samples were collected and handled in accordance with the US-EPA, Region IV, Science and Ecosystem Services Division, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM), May, 1996. The samples were analyzed in accordance with the Analytical Support Branch Laboratory Operations and Quality Control Manual, September, 1990.

References

(1) Southern States Phosphate & Fertilizer Co., Environmental Assessment & Remediation Plan, April 24, 1992.

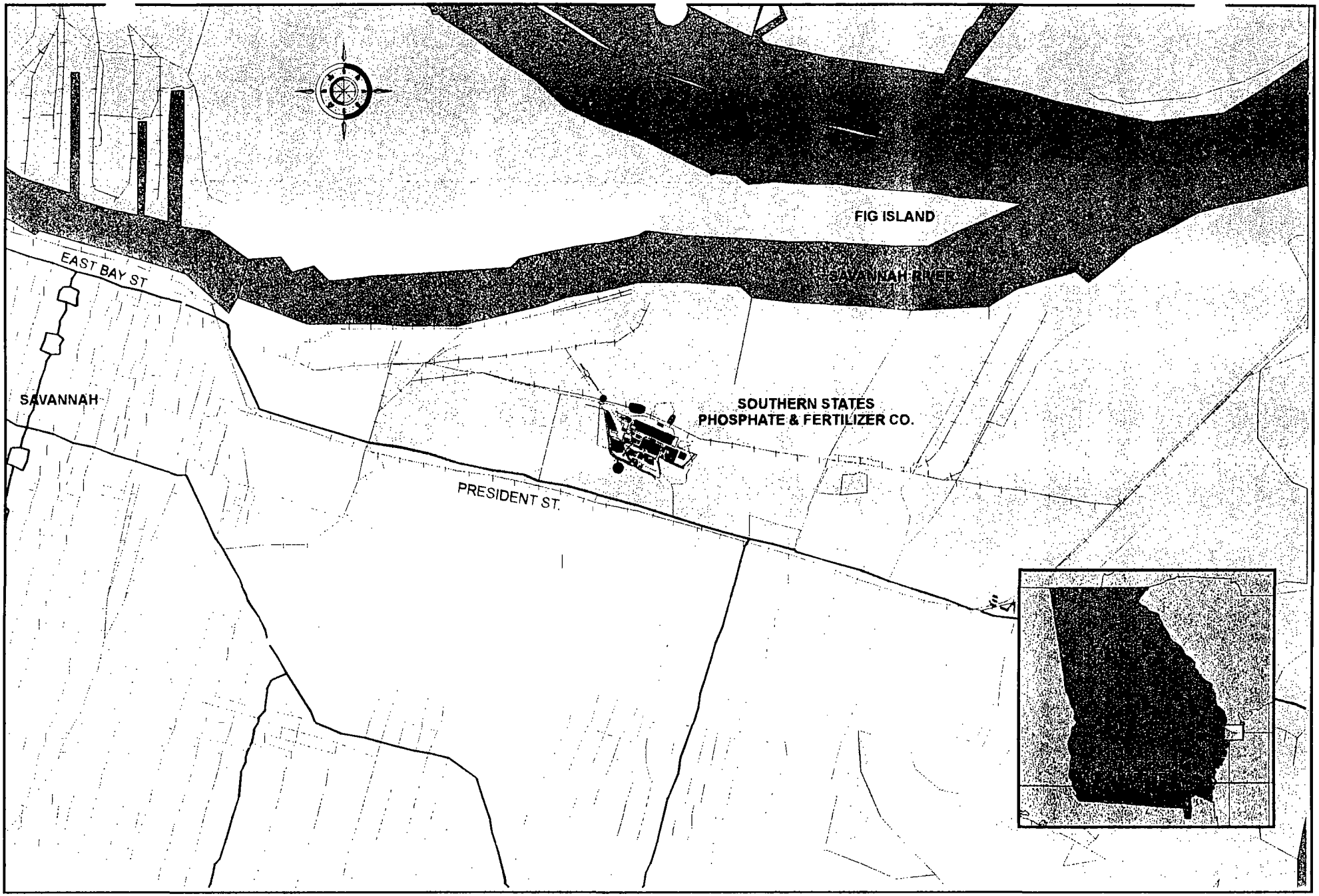

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FIGURE 1
SITE LOCATION MAP
SOUTHERN STATES PHOSPHATE & FERTILIZER CO.
SAVANNAH, GEORGIA

EPA

NOT TO SCALE

TABLE 1
ANALYTICAL RESULTS
GROUNDWATER SAMPLES
SOUTHERN STATES DIE
NOVEMBER 4-6, 1996

	REGION3 RBC VALUE TAP WATER	SS010GW CONTROL WELL 11/05/96 1535	SS012GW ACID CONTROL 11/05/96 1825	SS013GW ACID DOWNGRAD 11/05/96 2000	SS016GW EASTPOND CONTROL 11/06/96 1140	SS014GW EASTPOND DOWNGRAD 11/06/96 1620	SS017GW LANDFILL DOWNGRAD 11/06/96 1415
INORGANIC ELEMENTS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ARSENIC	0.045	--	**15**	**160**	**200**	--	--
BARIUM	2600	120	49	230	--	--	--
CADMIUM	18	--	--	--	**57**	--	--
COBALT	2200	--	--	12	180	11	--
CHROMIUM	180N*	--	17	160	95	--	--
COPPER	1500	--	30	26	280	98	51
MOLYBDENUM	180	--	18	--	--	--	--
NICKEL	730	--	26	210	390	60	400
LEAD	15*	--	**64**	**870**	**27**	**26**	12
STRONTIUM	22000	28	160	2000	1600	500	850
TITANIUM	**	17	120	3200	72	--	--
VANADIUM	260	--	14	35	230	--	--
ZINC	11000	--	58	840	**11000**	930	110
MERCURY	11	--	0.57	1.2	--	--	--
ALUMINUM	37000	2300	1400	34000	**75000**	1700	16000
MANGANESE	840	--	58	**940**	**43000**	**4300**	**5500**
	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	
CALCIUM	**	4.8	59	220	590	110	390
MAGNESIUM	**	0.36	10	20	190	16	130
IRON	11000	0.30	1.4	32	20	9.4	180
SODIUM	**	2.6	160	440	84	110	350
POTASSIUM	**	--	9.1	41	340	110	340
TCLP	**	NA	NA	NA	NA	NA	NA
SPECIFIED ANALYSIS	SU	SU	SU	SU	SU	SU	SU
pH	**	4.9	6.0	2.7	3.4	6.0A	4.5

FOOTNOTES
****

* - The value given is for chromiumVI, the value given for lead is the MCL
** - No published RBC value
NA - Not Analyzed

TABLE 2
ANALYTICAL RESULTS
SOIL SAMPLES
SOUTHERN STATES DIE
NOVEMBER 4-6, 1996

	REGION 3 RBC VALUE INDUSTRY SOIL	SS010SF CONTROL WELL 11/05/96 1350	SS012SF ACID CONTROL 11/05/96 1530	SS013SF ACID DOWNGRAD 11/05/96 1615	SS016SF EASTPOND CONTROL 11/06/96 0900	SS014SF EASTPOND DOWNGRAD 11/06/96 1005	SS017SF LANDFILL DOWNGRAD 11/06/96 1240	SS015SB CENTER LANDFILL 11/06/96 1330
INORGANIC ELEMENTS	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG
ARSENIC	3.8	2.0	**13**	**110**	2.7	**23**	**33**	**15**
BARIUM	140000	8.5	200	2400	68	120	77	99
CADMIUM	1000	--	--	--	--	--	--	3.9
COBALT	120000	--	--	--	1.2	--	16	10
CHROMIUM	1000000	3.8	8.4	14	9.9	150	74	41
COPPER	82000	19	30	260	28	190	100	140
MOLYBDENUM	10000	--	--	10	--	31	--	4.2
NICKEL	41000	--	--	--	2.7	78	68	18
LEAD	400*	30	**490**	**2400**	75	160	72	150
ANTIMONY	820	--	--	--	--	26	--	--
TIN	1000000	--	--	41	--	76	--	--
STRONTIUM	1000000	3.4	890	49	67	92	58	130
TITANIUM	**	60	140	88	460	150	720	450
VANADIUM	14000	2.6	--	--	12	21	130	47
YTTRIUM	**	1.0	--	--	12	--	17	26
ZINC	610000	6.9	74	190	61	64	470	490
MERCURY	610	--	0.12	0.32	0.11	0.34	0.14	0.20
ALUMINUM	1000000	3800	3600	930	4900	1300	64000	25000
MANGANESE	47000	5.7	110	39	80	400	380	180
CALCIUM	**	100	94000	2000	12000	36000	4300	34000
MAGNESIUM	**	120	17000	440	840	250	4100	3600
IRON	610000	1300	7200	72000	7000	100000	60000	32000
SODIUM	**	--	840	--	390	--	1200	350
POTASSIUM	**	--	--	--	1900	--	6800	2800
TCLP	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
ARSENIC	NA	NA	--	--	NA	--	0.059	0.61
LEAD	NA	NA	0.45	1.2	NA	--	--	--
SPECIFIED ANALYSIS	SU	SU	SU	SU	SU	SU	SU	SU
pH	NA	4.6	7.0	5.9	3.4A	2.5	5.4	5.6

FOOTNOTES
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* - The value given for lead is from the EPA Office of Solid Waste directive for residential soil.
** - No published RBC value
NA - Not Analyzed

TABLE 3
ANALYTICAL RESULTS
SURFACE WATER SAMPLES
SOUTHERN STATES DIE
NOVEMBER 4-6, 1996

	SS001SW HOLDING POND #2 11/05/96 1038	SS002SW BLDG DITCH 11/04/96 1620	SS003SW HOLDING POND #1 11/04/96 1705	SS004SW SCALES DITCH 11/04/96 1655	SS005SW ACID PLANT 11/05/96 1130	SS009SW WEST POND 11/05/96 1330	SS011SW EAST POND 11/05/96 1410
INORGANIC ELEMENTS	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L
ARSENIC	12	--	19	--	12	11	8.0
BARIUM	14	16	20	23	13	--	--
COBALT	--	--	--	--	--	--	17
COPPER	--	11	18	--	--	24	110
NICKEL	--	--	--	--	--	--	44
LEAD	12	--	35	24	9.2	--	--
STRONTIUM	--	320	390	371	400	280	770
ZINC	--	44	54	44	--	140	2600
MERCURY	0.22	--	0.21	0.22	--	--	0.21
ALUMINUM	110	--	840	690	--	310	1800
MANGANESE	--	23	44	23	--	230	4900
	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
CALCIUM	25	25	29	30	24	60	110
MAGNESIUM	9.0	8.2	8.8	8.2	8.8	12	15
IRON	0.34	10	1.4	0.48	0.24	0.12	0.15
SODIUM	23	10	19	12	18	16	130
POTASSIUM	--	--	2.1	2.0	--	40	120
TCLP	NA	NA	NA	NA	NA	NA	NA
S IFIED ANALYSIS	SU	SU	SU	SU	SU	SU	SU
pH	7.9	7.8	7.6	7.5	8.2A	7.8	5.7

FOOTNOTES
****

NA - Not Analyzed

TABLE 4
ANALYTICAL RESULTS
SEDIMENT SAMPLES
SOUTHERN STATES DIE
NOVEMBER 4-6, 1996

	SS001SD HOLDING POND #2 11/05/96 1050	SS002SD BLDG DITCH 11/04/96 1625	SS003SD HOLDING POND #1 11/04/96 1710	SS004SD SCALES DITCH 11/04/96 1700	SS005SD ACID PLANT 11/05/96 1135	SS009SD WEST POND 11/05/96 1350	SS011SD EAST POND 11/05/96 1420
INORGANIC ELEMENTS	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	MG/KG	
ARSENIC	46	24	440	13	29	29	--
BARIUM	670	730	690	220	320	320	140
CADMIUM	--	10	8.6	--	--	15	--
COBALT	--	--	9.6	--	--	--	--
CHROMIUM	7.7	56	100	33	--	82	110
COPPER	69	450	1100	360	66	820	190
NICKEL	--	--	21	--	--	50	--
LEAD	700	360	1400	210	420	380	540
ANTIMONY	25	--	--	--	--	--	--
TIN	15	--	40	--	--	--	75
STRONTIUM	840	880	690	2600	2800	1100	580
TITANIUM	200	280	530	140	430	620	790
VANADIUM	7.3	72	84	48	--	92	100
YTTRIUM	--	130	55	74	--	130	110
ZINC	110	1800	3400	1700	190	6100	490
MERCURY	1.5	--	3.7	0.06	0.36	0.47	2.0
ALUMINUM	1900	8000	41000	8400	4300	34000	11000
MANGANESE	89	850	910	1400	290	2100	110
CALCIUM	50000	240000	54000	240000	210000	140000	220000
MAGNESIUM	4400	2800	6200	2500	29000	4600	660
IRON	13000	18000	76000	11000	14000	26000	24000
SODIUM	--	3500	48000	3000	12000	2900	1900
POTASSIUM	--	--	--	--	--	--	5200
TCLP	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L	MG/L
ARSENIC	0.23	0.54	0.18	--	--	0.077	--
LEAD	2.2	--	0.39	--	0.16	--	--
ANTIMONY	0.28	--	--	--	--	--	--
SPECIFIED ANALYSIS	SU	SU	SU	SU	SU	SU	SU
pH	7.5	6.6	9.7	6.9A	11	7.1	4.8A

FOOTNOTES
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NA - Not Analyzed

TABLE 5
ANALYTICAL RESULTS
CONCENTRATED SAMPLES
SOUTHERN STATES DIE
NOVEMBER 4-6, 1996

	SS006WA FORMER BASE "A" 11/05/96 1100	SS007WA NO. 12 MATERIAL 11/05/96 1130	SS008WA SULFUR PILE 11/05/96 1155
INORGANIC ELEMENTS	MG/KG	MG/KG	MG/KG
ARSENIC	22	76	11
BARIUM	250	1400	24
BERYLLIUM	--	37	--
CADMIUM	--	53	--
COBALT	24	270	--
CHROMIUM	100	110	3.1
COPPER	1600	62000	26
NICKEL	34	460	4.3
LEAD	220	1500	1200
TIN	49	520	--
STRONTIUM	1200	200	40
TITANIUM	--	--	81
VANADIUM	140	110	38
YTTRIUM	22	--	--
ZINC	5800	84000	40
MERCURY	1.3	180	0.40
ALUMINUM	4600	19000	340
MANGANESE	12000	130000	49
CALCIUM	120000	31000	7400
MAGNESIUM	9000	3100	300
IRON	23000	33000	22000
SODIUM	1300	27000	290
POTASSIUM	7100	14000	--
TCLP	MG/L	MG/L	MG/L
CADMIUM	--	0.54	--
LEAD	--	0.12	**16**
MERCURY	--	0.007	--
SPECIFIED ANALYSIS	SU	SU	SU
pH	6.9	9.2A	1.4

FOOTNOTES
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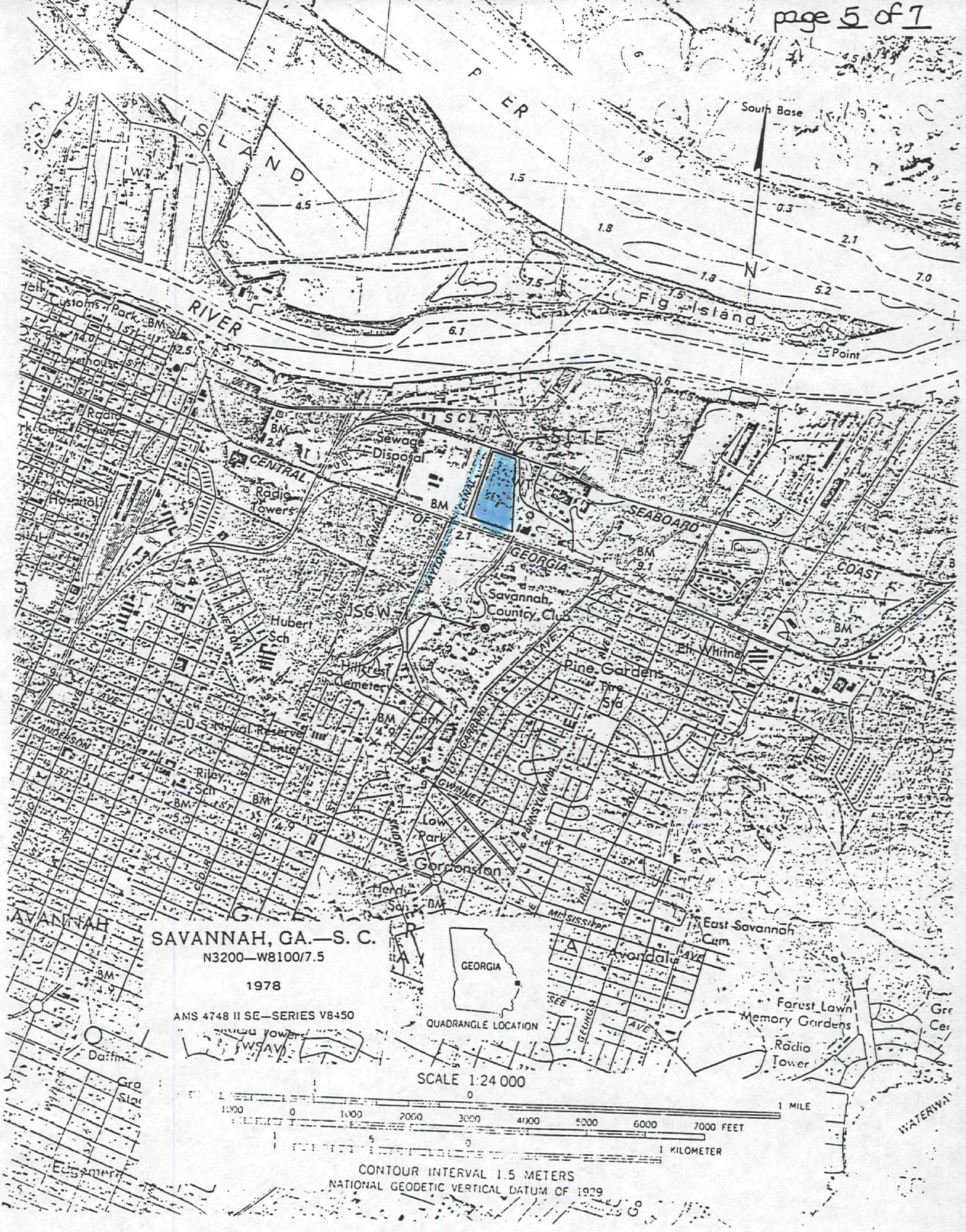
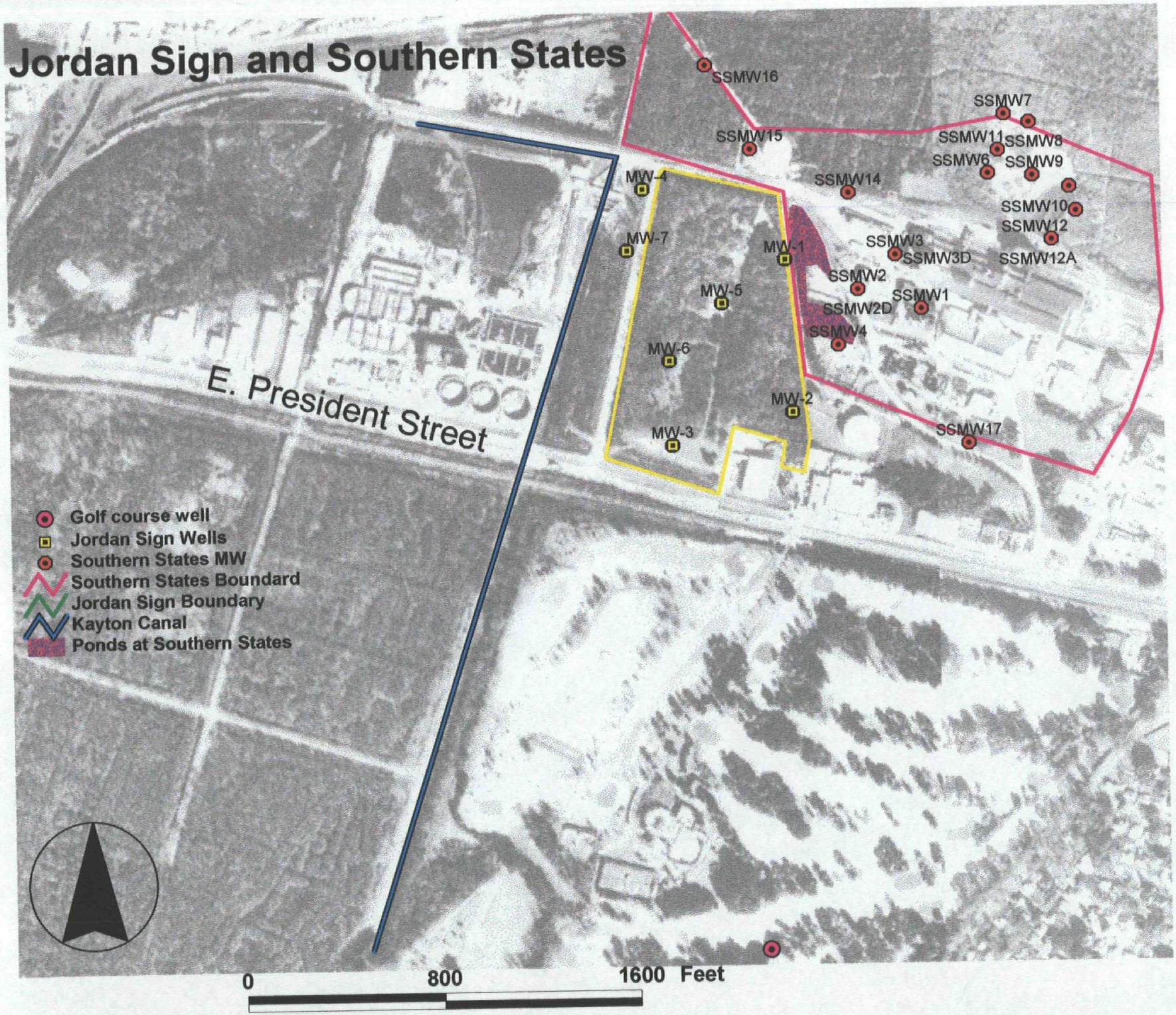
NA - Not Analyzed

APPENDIX A



from 9/12/88 GA EPD Trip Report


Jordan Sign and Southern States
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SSMW7
SSMW15
SSMW11
SSMW8
SSMW6
SSMW9
MW-4
SSMW14
SSMW10
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MW-1
SSMW3
SSMW3D
SSMW12A
SSMW2
MW-5
SSMW1
SSMW2D
SSMW4
MW-6
MW-2
SSMW17
MW-3
E. President Street
Golf course well
Jordan Sign Wells
Southern States MW
Southern States Boundard
Jordan Sign Boundary
Kayton Canal
Ponds at Southern States
0
800
1600 Feet

HUNTER, MACLEAN, EXLEY & DUNN, P.C.

ATTORNEYS AT LAW

SAVANNAH OFFICE:
POST OFFICE BOX 9848
SAVANNAH, GEORGIA 31412-0048
TELEPHONE: (912) 236-0261
FACSIMILE: (912) 236-4936
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200 EAST SAINT JULIAN STREET
SAVANNAH, GEORGIA 31401

ANDREW H. ERNST
SAVANNAH OFFICE

ATLANTA OFFICE:
1355 PEACHTREE STREET, N.E.
SUITE 640
ATLANTA, GEORGIA 30309
TELEPHONE: (404) 876-3611
FACSIMILE: (404) 870-2025

June 10, 1999

J 1999

VIA FACSIMILE
(404) 651-9425
Ms. Ann Roat
Hazardous Waste Management Branch
Georgia Department of Natural Resources
205 Butler Street, S.E.
Suite 1154
Atlanta, GA 30334

FILE COPY

RE: Proposed Consent Order, Southern States Phosphate and Fertilizer Company

Dear Ms. Roat:

Per our discussion last week, enclosed you will find a copy of the Exhibit which was sent to me by Mr. Compton at Southern States. This Exhibit identifies two piles of pyrite located at the facility.

As you and I discussed, the order was a little ambiguous as to the location of materials to be removed. I will use this Exhibit in an effort to more clearly define those sites needing removal.

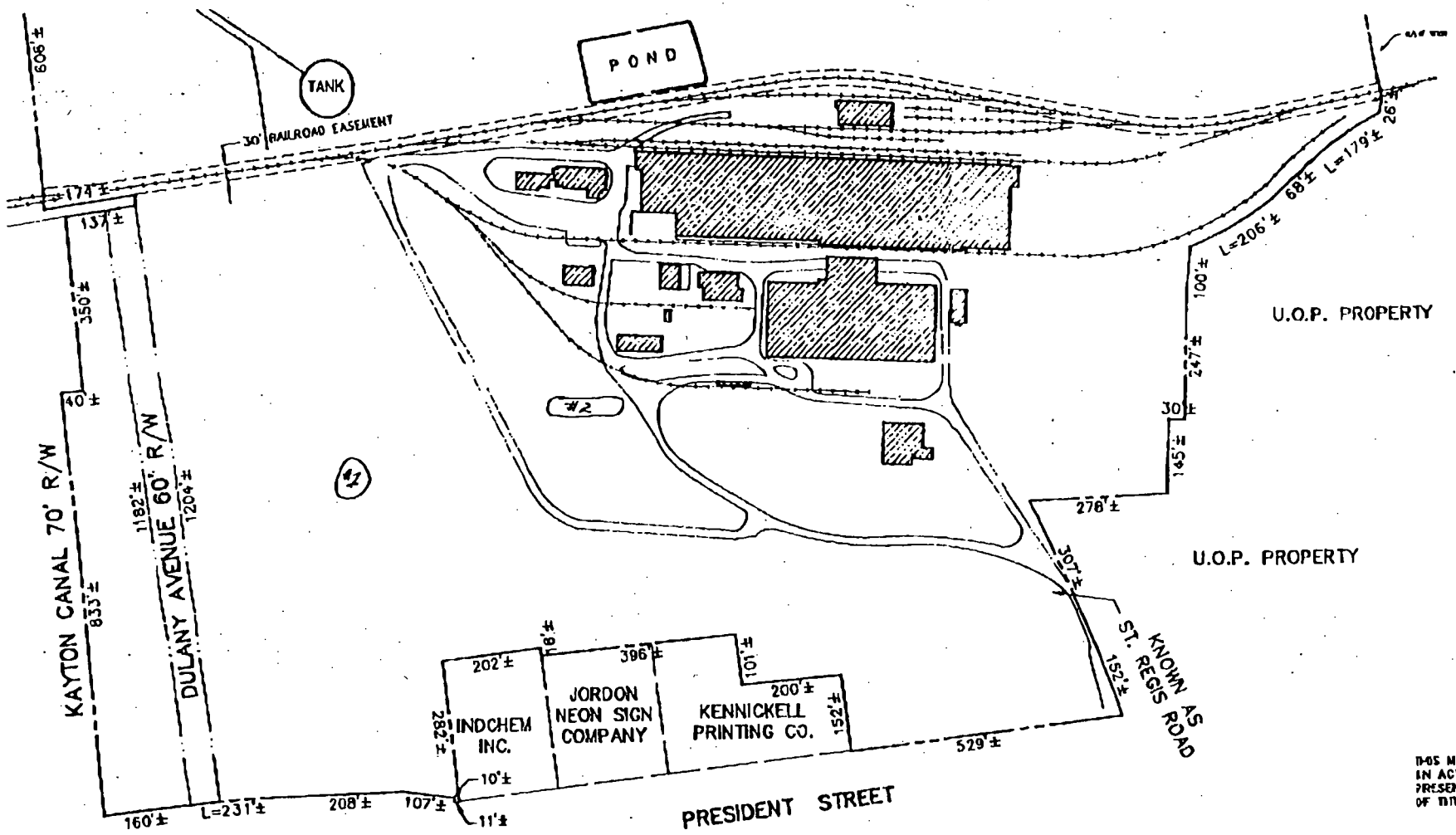
I hope to have revised consent order for your consideration within the next few days. With best regards, I am

Very truly yours,

Andrew H. Ernst

AHE/aha
Enclosure
cc: Mr. Keith Compton

(244513-1) 5681-5



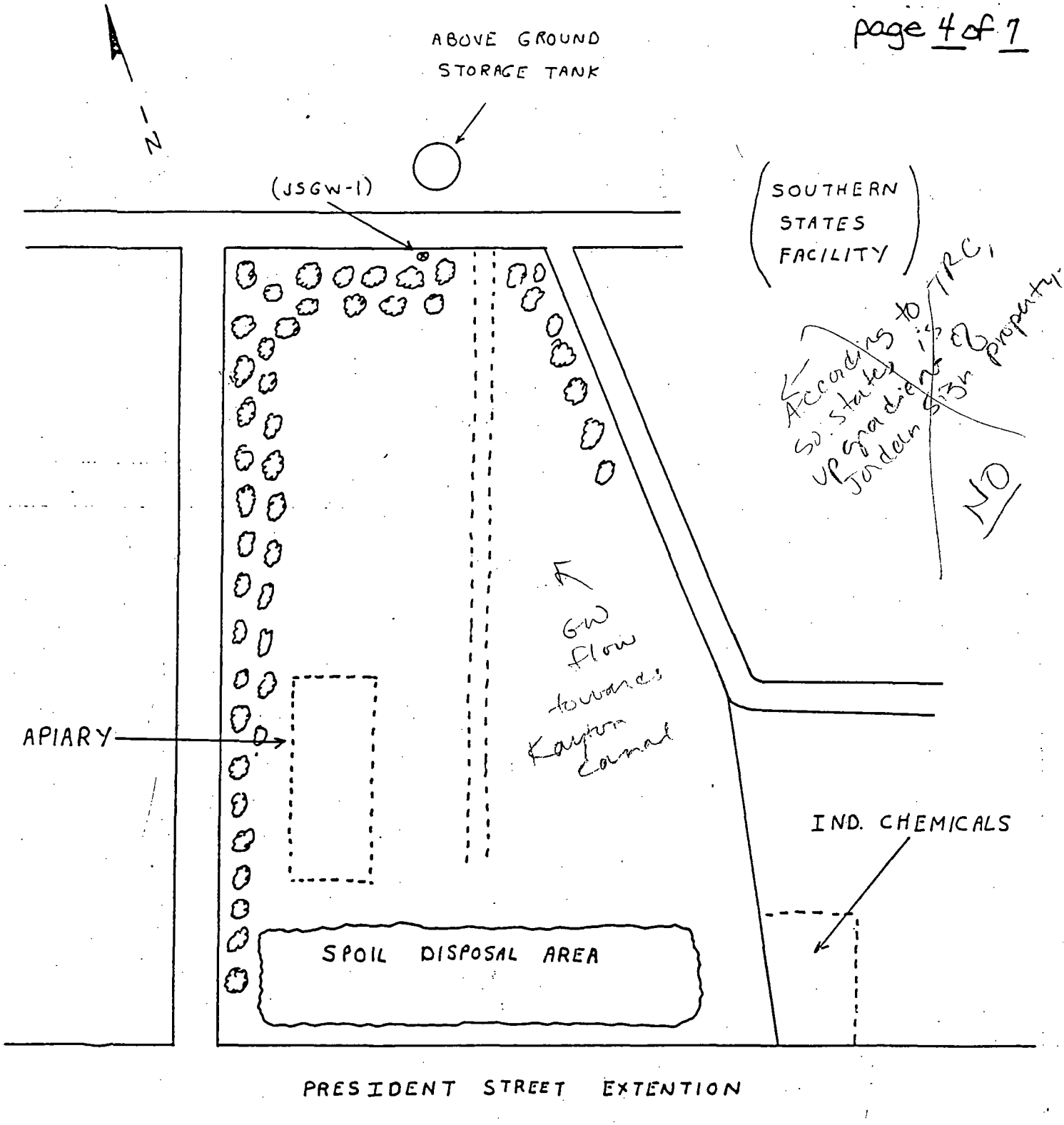
Pile #1 Approx 15 tons
Pile #2 Approx 250 tons

THIS MAP WAS COMPILED F
IN ACTUAL FIELD SURVEY.
PRESENT OWNER AND IS N
OF TITLE TO REAL PROPER

COMPILED MAP OF
PHOSPHATE & FER
PRESIDENT STREET,

SOUTHERN STATES
PHOSPHATE & FERTILIZER CO.

DATE: FEBRUARY 7, 1994
SCALE: 1"= 200'



JORDAN SIGN COMPANY SITE
GAD003293057
(SITE SKETCH)

1" = 400'

From 9/12/88 GA EPD Trip Report